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ABSTRACT

In this set of eight booklets on graphing, primary grade students learn how to choose which graph to make and how to make a bar graph, bar graph histogram, conversion graph, line chart, line graph, scatter graph, and slope diagram. The major emphasis in all Unified Sciences and Mathematics for Elementary Schools (USMES) units is on open-ended, long-range investigations of real problems. In most instances students learn through observing results of their own and their classmates' experiments. However, students may recognize the need for certain facts and/or skills during their investigations. Although some children prefer to work things out for themselves, others may ask for help. USMES "How To Sets" are designed to provide such assistance. Each booklet in a set contains several examples of children using a skill being taught, each example emphasizing a different aspect of the skill or a potential pitfall. Cover pages summarize what is being taught by illustrating the general problem and solution. There is no sequence to the sets (or booklets within sets) and they should not be used out of the context of childrens' open investigation of a practical problem. (Author/JN)

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ED220329

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS

HOW TO SET
GRAPHING

IN THIS SET
STUDENTS
WILL FIND
OUT HOW TO ...

- CHOOSE WHICH GRAPH TO MAKE
- MAKE A BAR GRAPH
- MAKE A BAR GRAPH HISTOGRAM
- MAKE A CONVERSION GRAPH
- MAKE A LINE CHART
- MAKE A LINE GRAPH
- MAKE A SCATTER GRAPH
- MAKE A SLOPE DIAGRAM

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SE 039 091

WHAT IS USMES?

USMES challenges students to solve real problems within their school and community. Children tackle problems like a busy or unsafe intersection near their school, classroom furniture that doesn't fit them, or playgrounds that are crowded or uninteresting. These problems have immediate and practical impact on students. They have no established, correct solutions--students take or recommend action based upon whatever data they collect and analyze. Furthermore, the children themselves, not the teacher, direct the problem-solving process.

Solving real problems is interdisciplinary: skills, processes, and concepts from science, mathematics, social science, and language arts all play a part. For example, students conduct opinion surveys, build measuring devices, write letters, and make and use graphs. They also make decisions, work productively in small groups, and develop and clarify values.

The USMES curriculum is organized into twenty-six problems, or units, that have been developed in the classroom by teachers and students in a wide variety of schools. Most units can be used in grades K-8 although the level at which students approach a problem and develop a solution will vary according to age, ability, and interest.

RESOURCES FOR AN USMES PROGRAM

In addition to the USMES "How To" Series, there are--

The USMES Guide: This book describes the USMES project, real problem solving, classroom strategies, the Design Lab, the units, and the support materials as well as ways that USMES helps students learn basic skills.

Teacher Resource Books (one per unit): Each of these guides to using USMES units describes a broad problem, explains how students might narrow that problem to meet their particular needs, recommends classroom strategies, and presents logs from teachers whose classes have worked on the unit.

Design Lab Manual: This guide helps teachers and administrators set up, run, and use a Design Lab--a place with tools and materials where students can build things they need for their work on USMES units. A Design Lab may be a corner of a classroom, a portable cart, or a separate room.

Background Papers: These papers, correlated with the "How To" Series, provide teachers with information and hints that do not appear in the student materials.

Curriculum Correlation Guide: By correlating the twenty-six USMES units with other curriculum materials, this book helps teachers integrate USMES with other school activities and lessons.

The "How To" Series is a resource developed by the USMES project. Earle L. Lomon, Project Director, Betty M. Beck, Associate Director for Development, Thomas L. Brown, Associate Director for Utilization Studies, Quinton E. Baker, Associate Director for Administration.

This material is based upon research supported by the National Science Foundation under Grant No. SED69-01071. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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Complete USMES Library ISBN 0-89292-033-5
Beginning "How To" Series ISBN 0-89292-029-7

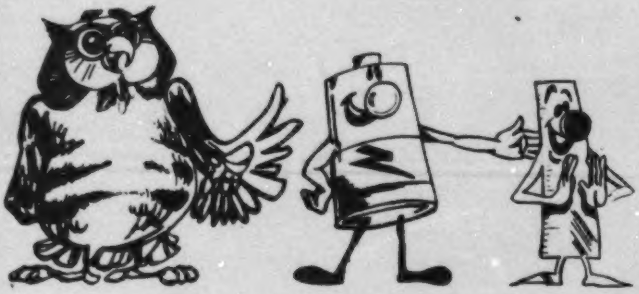
THE USMES BEGINNING "HOW TO" SERIES

USMES and Skills

USMES students often see a need to learn new skills to help them get a problem-solving job done. Children seeking to improve a street crossing may want to learn how to use a stopwatch or how to make a trundle wheel. Children comparing different brands of paper towels may want to learn how to design an experiment and how to make a bar graph. The list can go on and on, but the pattern is clear; solving a real problem requires skills.

Purpose of 'How To' Series

Written resources that help children learn skills like designing an opinion survey and choosing the appropriate measuring tool are not readily available for elementary school students. However, the USMES "How To" Series fills this gap. Its cartoon-style format helps younger children and those with reading difficulties acquire the skills and knowledge they need to do things like redesign their classroom, find the best buy in potato chips, or run a school store.



How to Use the 'How To' Series

Wait for a need. When a student asks for help, refer him or her to the appropriate booklet. Having a child read a booklet before there is a need to do so will not only result in less effective learning but will defeat the USMES purpose of allowing children to decide what needs to be done.

When necessary, use the "How To" Series as a teaching aid. Most of the time children will be able to go through a booklet by themselves and learn the skills they need to learn. However, some material in some sets is difficult and somewhat abstract. Such sections are usually towards the ends of booklets and often labeled "extra." When the booklet by itself is not doing the job, feel free to step in and help the student go through it.

Knowing how the content of the booklets are organized may help in using the series effectively.

- Each cover page summarizes what is in the booklet by illustrating the general problem and solution.
- Each booklet contains several examples of children using the skill being taught. Each example emphasizes a different aspect of the skill or a potential pitfall.
- Where a skill covered in one booklet is used in another, there is a reference in the form: See "How To...."

OTHER USMES 'HOW TO' SERIES

Intermediate "How To" Series: This magazine-style series covers in more detail essentially the same material as the cartoon-style series with a few booklets on additional skills. This series gives students a chance to read something they have a need to read.

Design Lab "How To" Series: These illustrated cards help children learn how to use tools safely and effectively.

"How To" Cards: These cards are printed on colored card stock rather than paper as the other series are. They contain fewer words than the *Intermediate "How To" Series* and utilize the American system of units (ft.-lb.-sec.) rather than the metric system.

BEGINNING "HOW TO" SERIES

BIOLOGY

How To
- Make a Home for Your Animal
- Make a Home for Your Rodent

COLLECTING DATA

How To
- Record Data
- Do an Experiment
- Make an Opinion Survey
- Choose a Sample

ELECTRICITY

How To
- Make Simple Circuits
- Make a Circuit Stay Together
- Add Things to a Circuit
- Make and Use Switches
- Fix a Circuit

GRAPHING

How To
- Choose Which Graph to Make
- Make a Bar Graph
- Make a Bar Graph Histogram
- Make a Conversion Graph
- Make a Line Chart
- Make a Line Graph
- Make a Scatter Graph
- Make a Slope Diagram

MEASURING

How To
- Use a Stopwatch
- Choose the Right Tool to Measure Distance
- Use a Trundle Wheel
- Make a Scale Drawing
- Find the Speed of Things

SIMPLIFYING DATA

How To
- Round Off Data
- Find the Median
- Find the Average

Conceived and Written by:
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John M. Evans

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John W. Saalfield

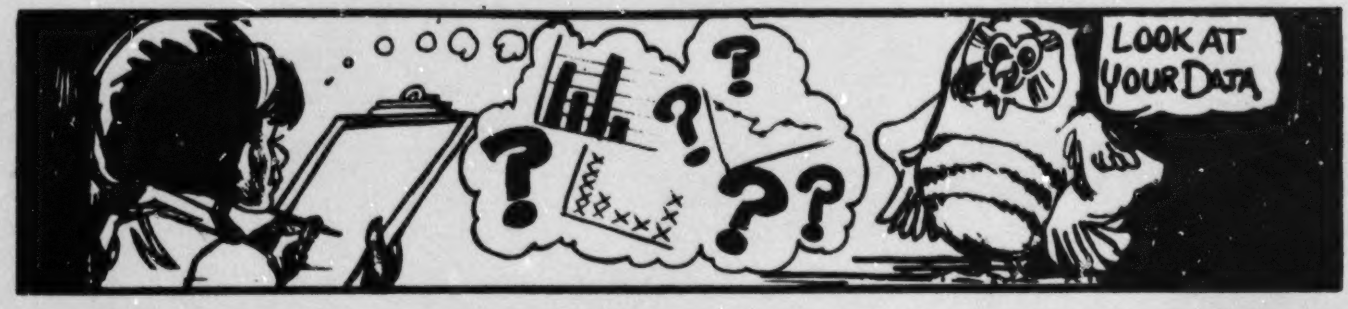
edc

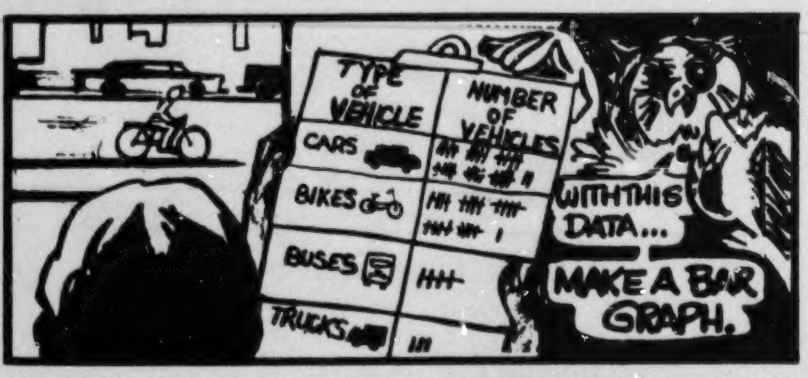
Production Assistance
Paula Lakeberg, Peter D. Zevitas

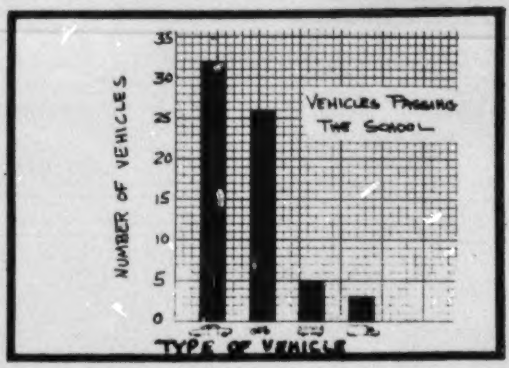
HOW TO

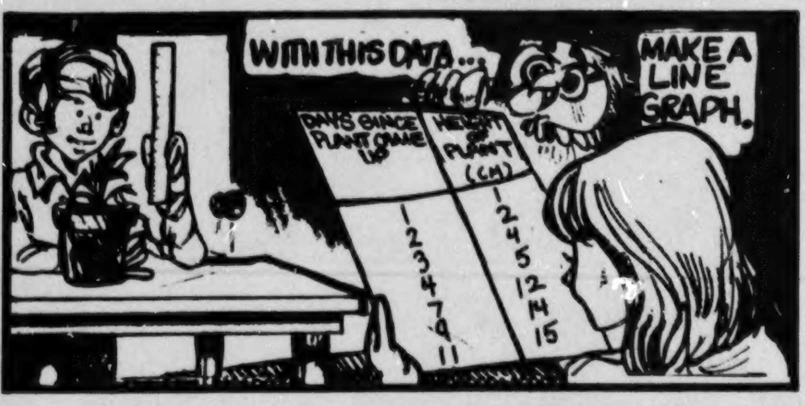
CHOOSE WHICH GRAPH TO MAKE

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS

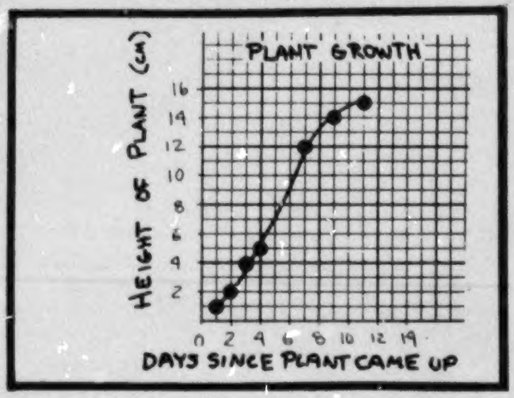

?
? ?
LOOK AT YOUR DATA

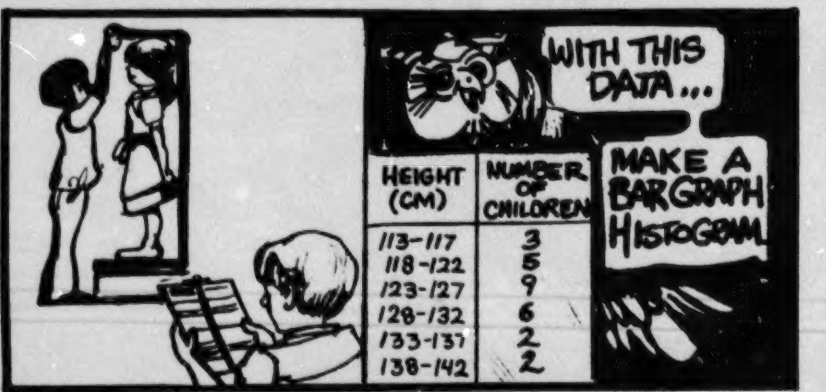

TYPE OF VEHICLE
NUMBER OF VEHICLES
CARS
BIKES
BUSES
TRUCKS
WITH THIS DATA...
MAKE A BAR GRAPH.



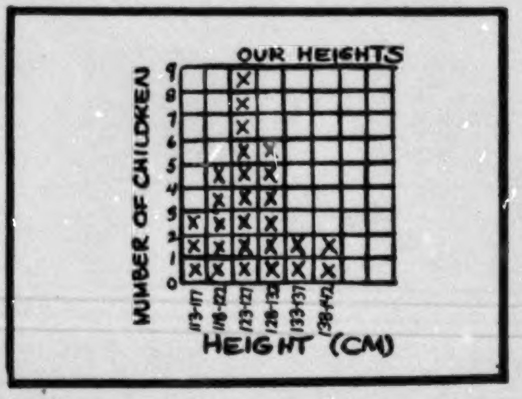

WITH THIS DATA...
MAKE A LINE GRAPH.

DAYS SINCE PLANT CAME UP	HEIGHT OF PLANT (CM)
1	1
2	2
3	4
4	5
7	12
9	14
11	15




WITH THIS DATA...
MAKE A BAR GRAPH HISTOGRAM

HEIGHT (CM)	NUMBER OF CHILDREN
113-117	3
118-122	5
123-127	9
128-132	6
133-137	2
138-142	2



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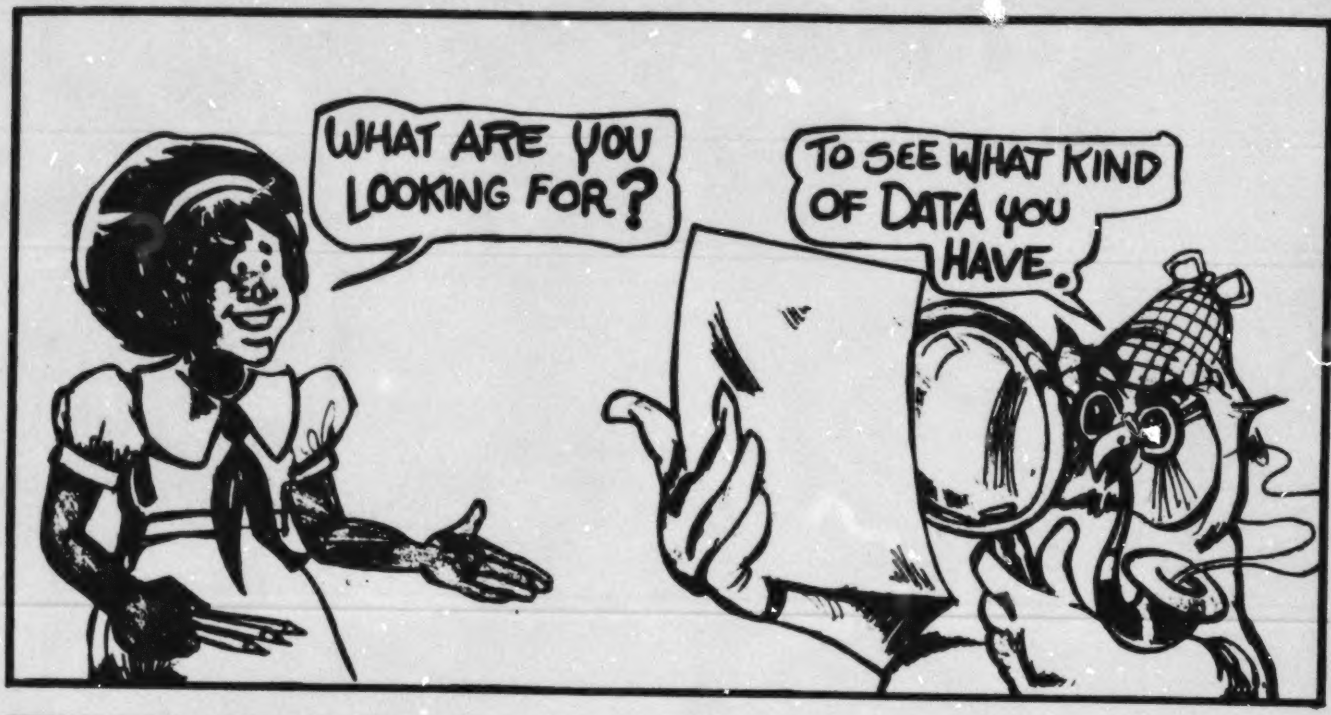
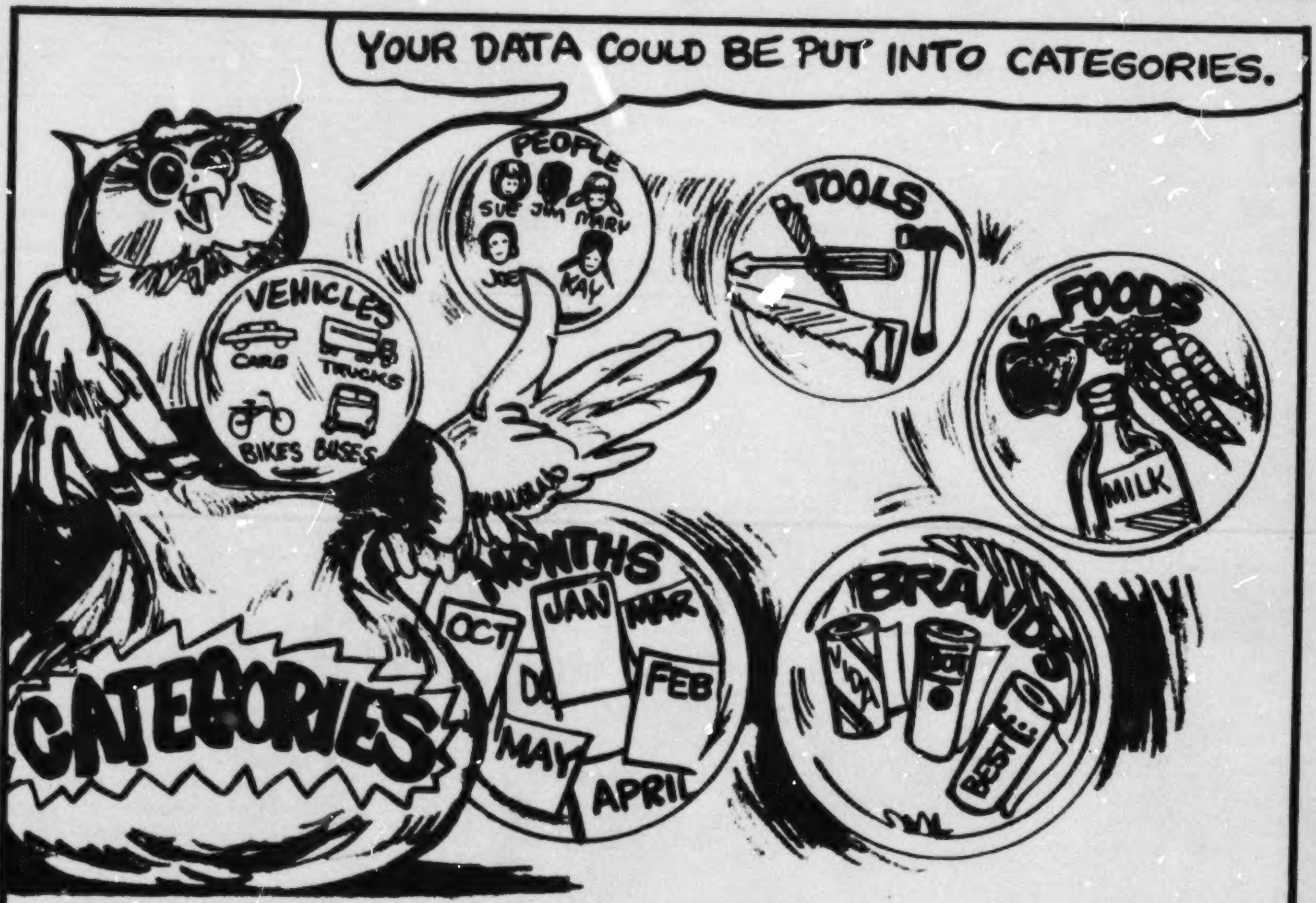
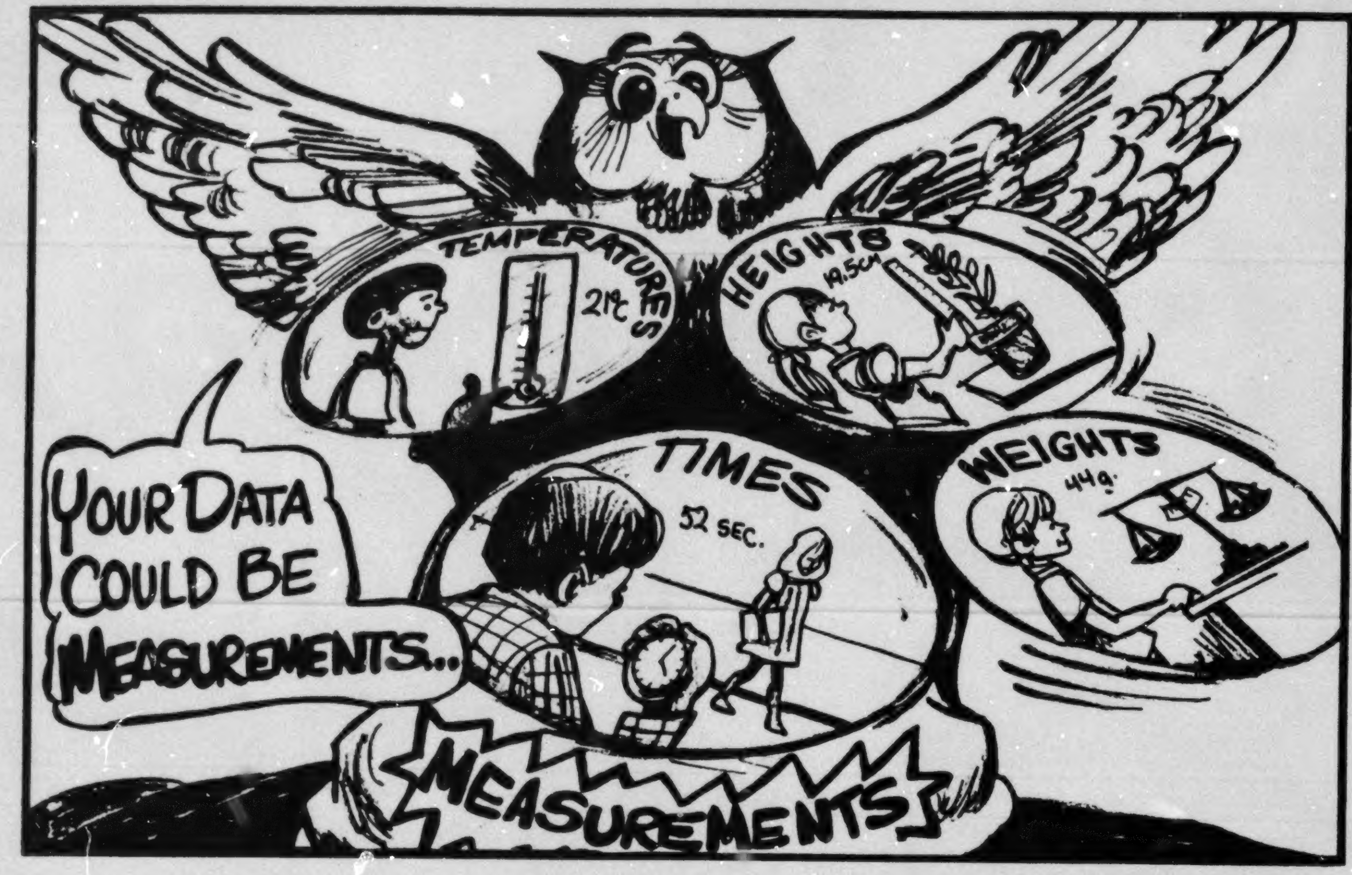
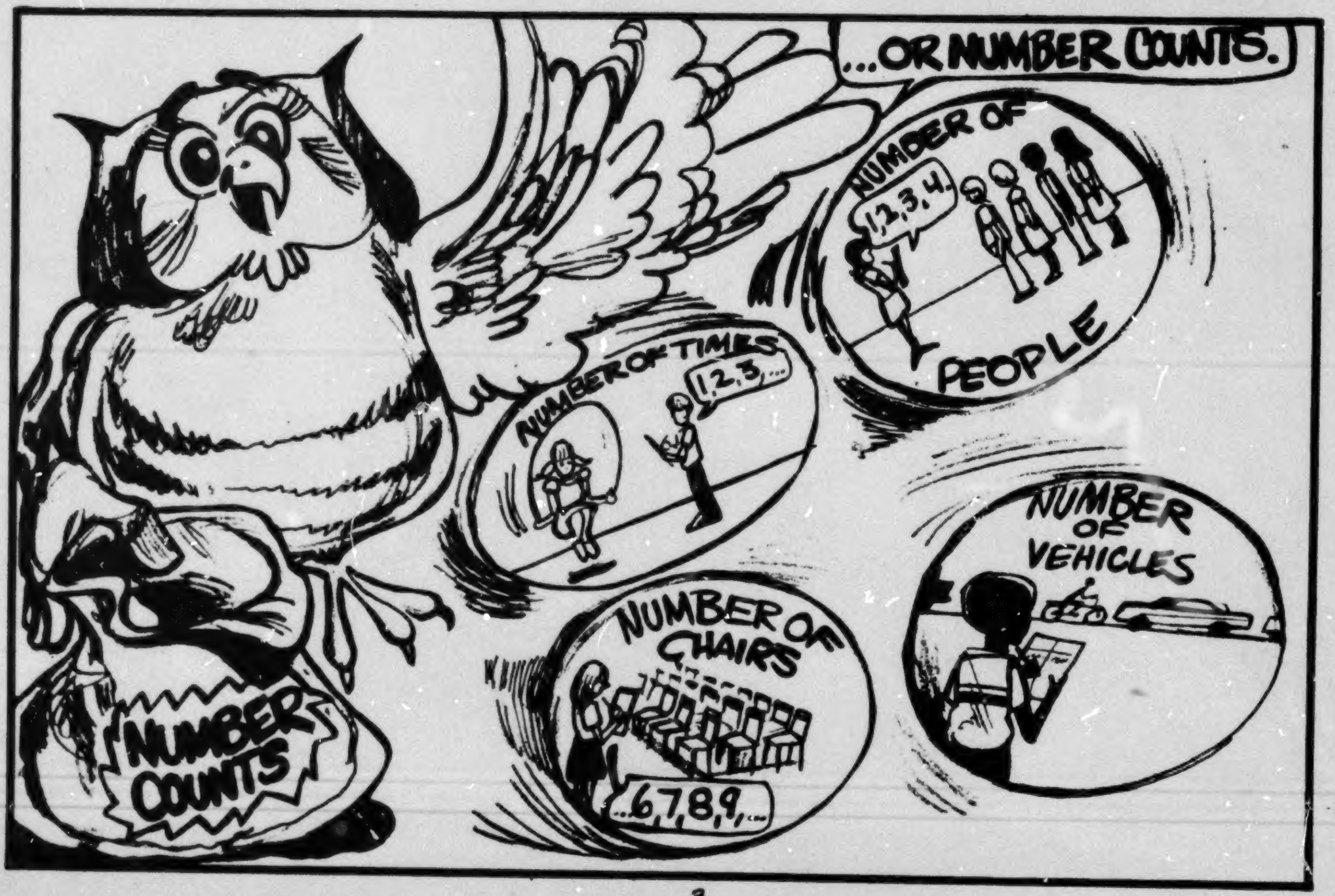
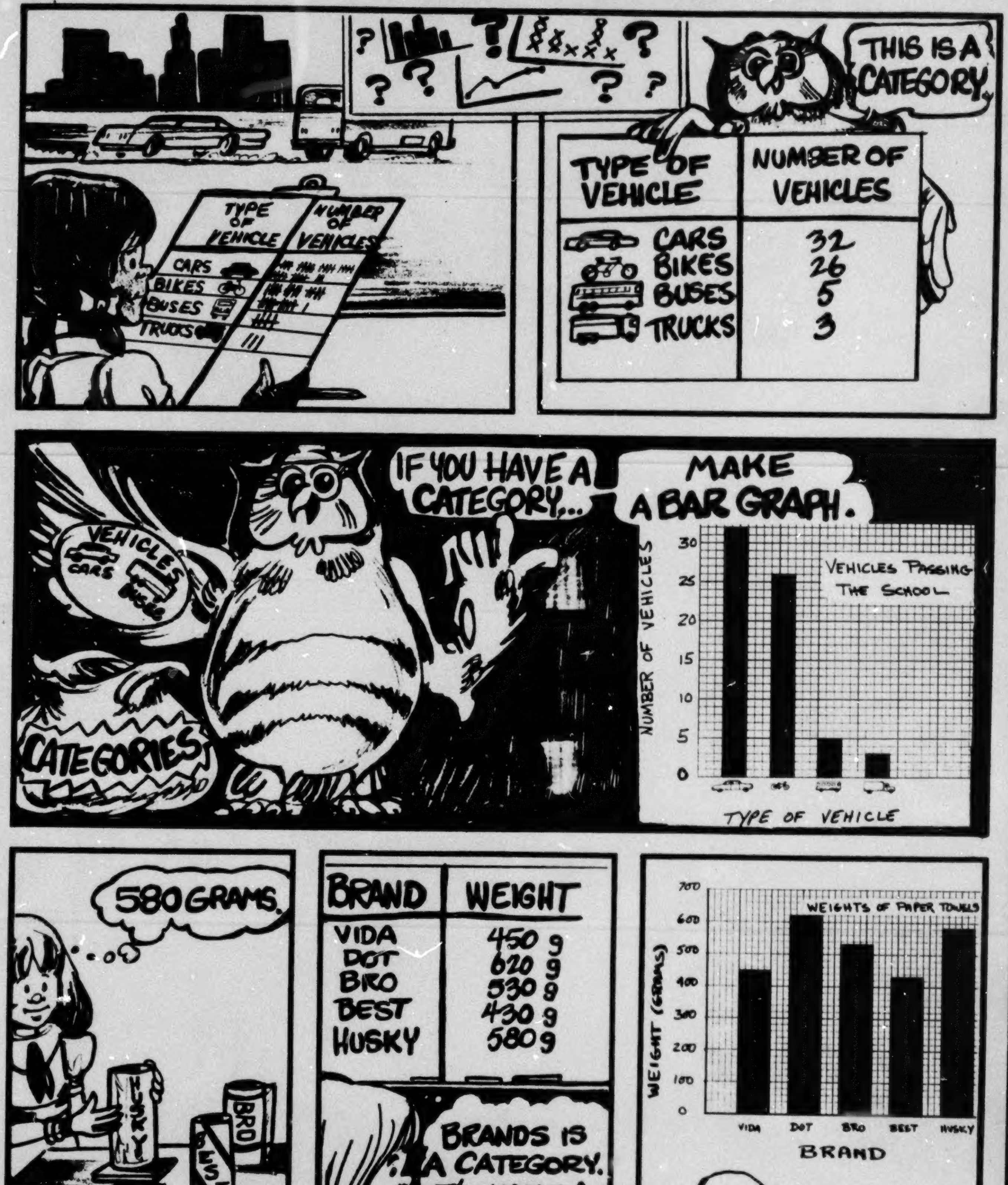
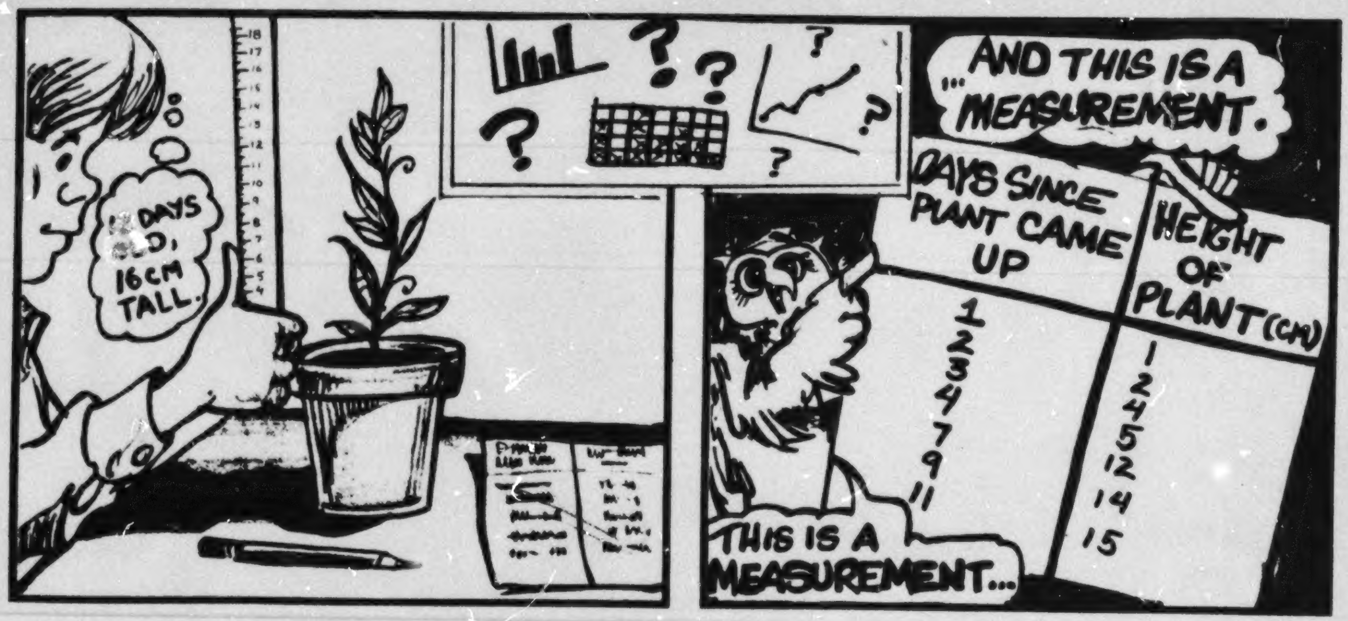

WHAT ARE YOU LOOKING FOR?
TO SEE WHAT KIND OF DATA YOU HAVE.

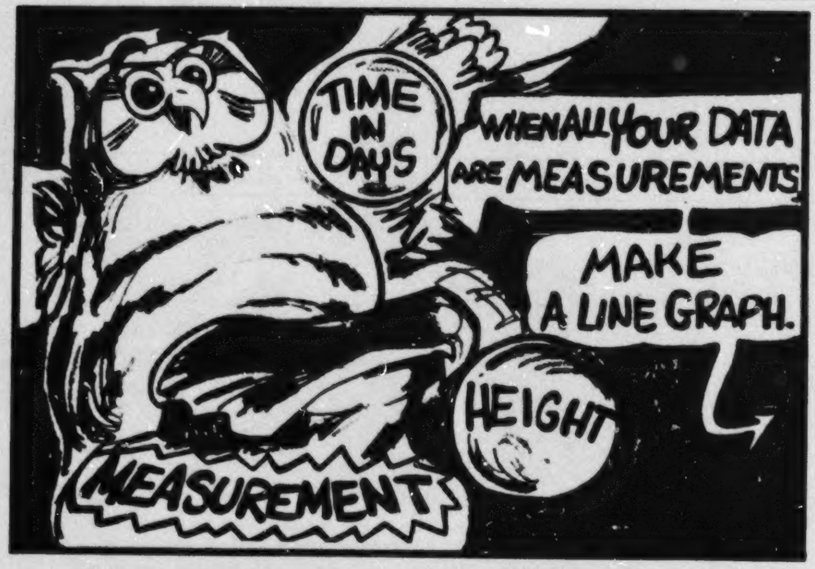

YOUR DATA COULD BE PUT INTO CATEGORIES.
PEOPLE
SUE
JIM
MARV
JOE
KAY
TOOLS
VEHICLES
CARS
TRUCKS
BIKES
BUSES
FOODS
MILK
MONTHS
OCT
JAN
MAR
FEB
MAY
APRIL
BRANDS
VIDA
BESTE
CATEGORIES

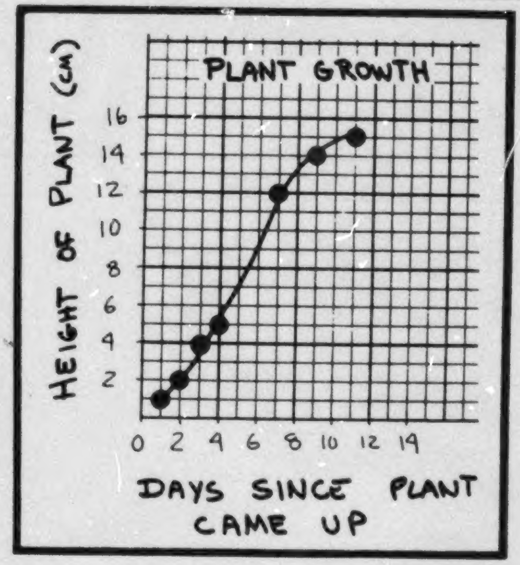

TEMPERATURES
21°C
HEIGHTS
19.5cm
TIMES
52 SEC.
WEIGHTS
44g.
YOUR DATA COULD BE MEASUREMENTS...
MEASUREMENTS

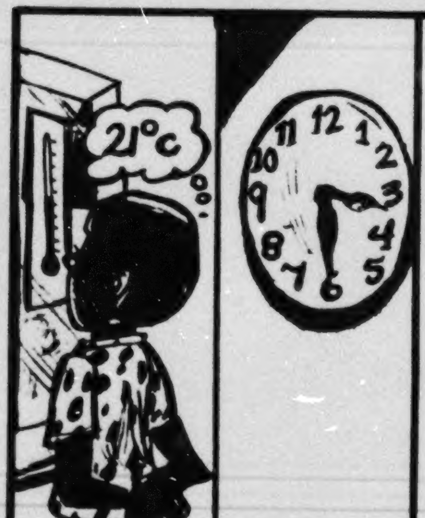

...OR NUMBER COUNTS.
NUMBER OF PEOPLE
1,2,3,4,
NUMBER OF TIMES
1,2,3,...
NUMBER OF CHAIRS
...6,7,8,9,...
NUMBER OF VEHICLES
NUMBER COUNTS

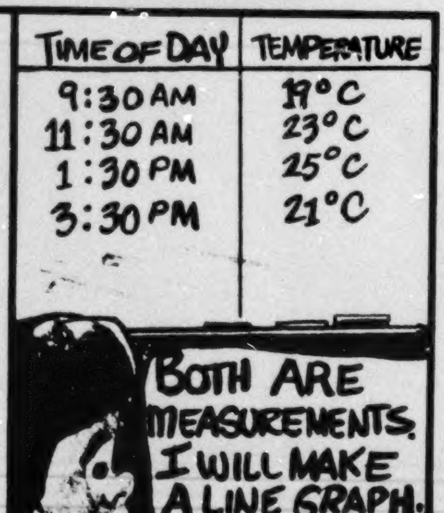

TYPE OF VEHICLE
NUMBER OF VEHICLES
CARS
BIKES
BUSES
TRUCKS
THIS IS A CATEGORY.
TYPE OF VEHICLE | NUMBER OF VEHICLES
CARS 32
BIKES 26
BUSES 5
TRUCKS 3
VEHICLES
CARS
BUSES
CATEGORIES
IF YOU HAVE A CATEGORY,...
MAKE A BAR GRAPH.
VEHICLES PASSING THE SCHOOL
NUMBER OF VEHICLES
0 5 10 15 20 25 30
TYPE OF VEHICLE
580 GRAMS.
HUSKY
BRO
BEST
BRAND
VIDA
DOT
BRAND | WEIGHT
VIDA 450 g
DOT 620 g
BRO 530 g
BEST 430 g
HUSKY 580 g
BRANDS IS A CATEGORY. I'LL MAKE A BAR GRAPH.
WEIGHTS OF PAPER TOWELS
WEIGHT (GRAMS)
0 100 200 300 400 500 600 700
VIDA DOT BRO BEST HUSKY
BRAND

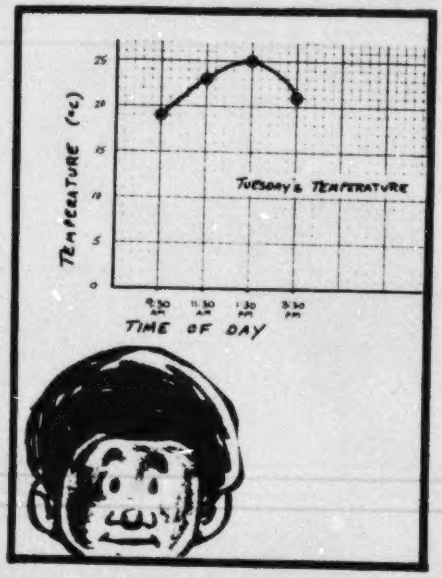

12 DAYS OLD, 16CM TALL.
...AND THIS IS A MEASUREMENT.
DAYS SINCE PLANT CAME UP
1
2
3
4
7
9
11
HEIGHT OF PLANT (CM)
1
2
4
5
12
14
15
THIS IS A MEASUREMENT...

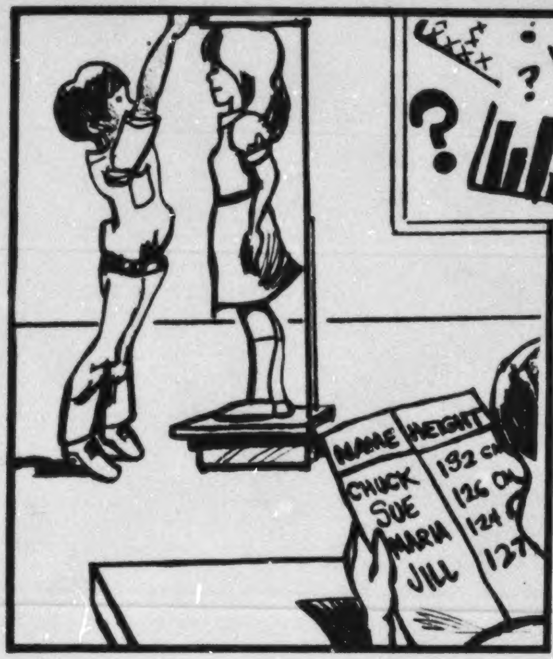

TIME IN DAYS
WHEN ALL YOUR DATA ARE MEASUREMENTS
MAKE A LINE GRAPH.
HEIGHT
MEASUREMENT

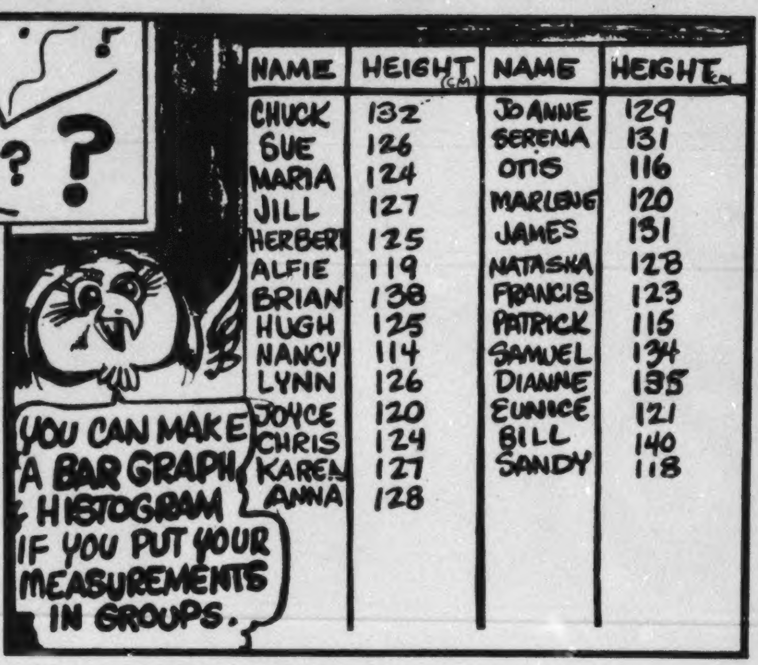

PLANT GROWTH
HEIGHT OF PLANT (CM)
16
14
12
10
8
6
4
2
0
2
4
6
8
10
12
14
DAYS SINCE PLANT CAME UP


21°C

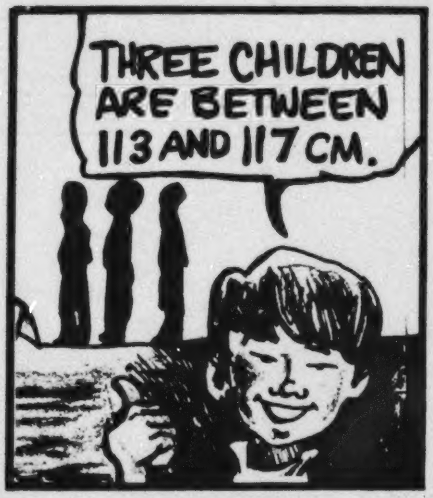

TIME OF DAY
TEMPERATURE
9:30 AM
19°C
11:30 AM
23°C
1:30 PM
25°C
3:30 PM
21°C
BOTH ARE MEASUREMENTS. I WILL MAKE A LINE GRAPH.

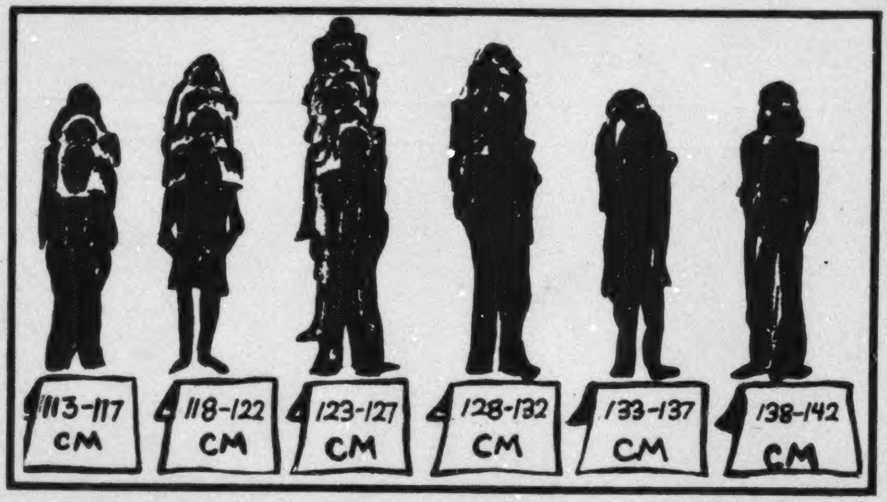

TEMPERATURE (°C)
25
20
15
10
5
0
TUESDAY'S TEMPERATURE
9:30 AM
11:30 AM
1:30 PM
3:30 PM
TIME OF DAY

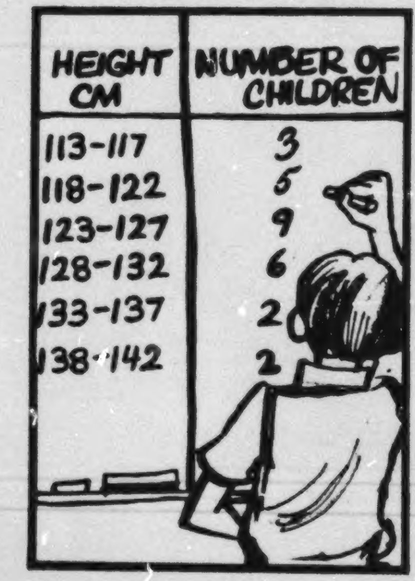

NAME HEIGHT
CHUCK 132 CM
SUE 126 CM
MARIA 124 C
JILL 127


YOU CAN MAKE A BAR GRAPH HISTOGRAM IF YOU PUT YOUR MEASUREMENTS IN GROUPS.

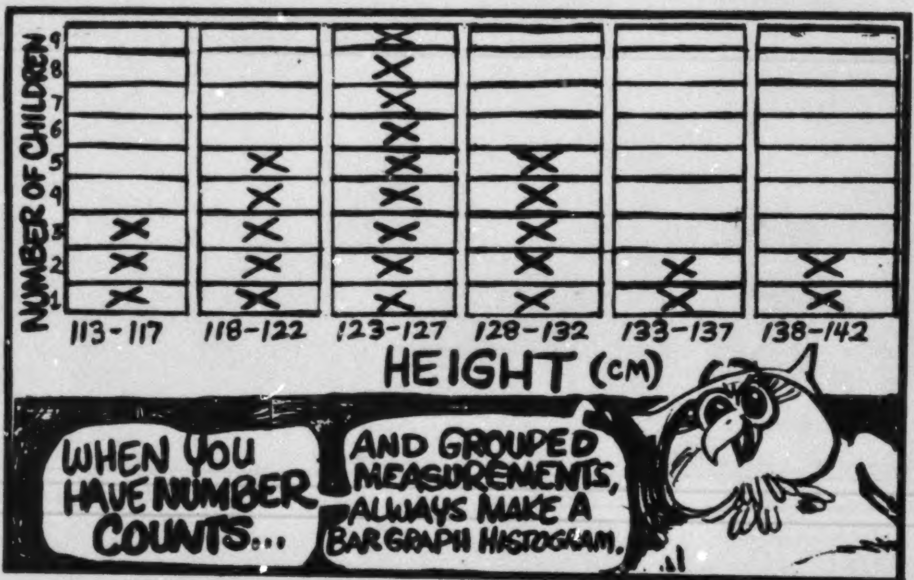
NAME	HEIGHT (CM)	NAME	HEIGHT
CHUCK	132	JoANNE	129
SUE	126	SERENA	131
MARIA	124	OTIS	116
JILL	127	MARLENE	120
HERBERT	125	JAMES	131
ALFIE	119	NATASHA	128
BRIAN	138	FRANCIS	123
HUGH	125	PATRICK	115
NANCY	114	SAMUEL	134
LYNN	126	DIANNE	135
JOYCE	120	EUNICE	121
CHRIS	124	BILL	140
KAREN	127	SANDY	118
ANNA	128		


THREE CHILDREN ARE BETWEEN 113 AND 117 CM.


113-117 CM
118-122 CM
123-127 CM
128-132 CM
133-137 CM
138-142 CM

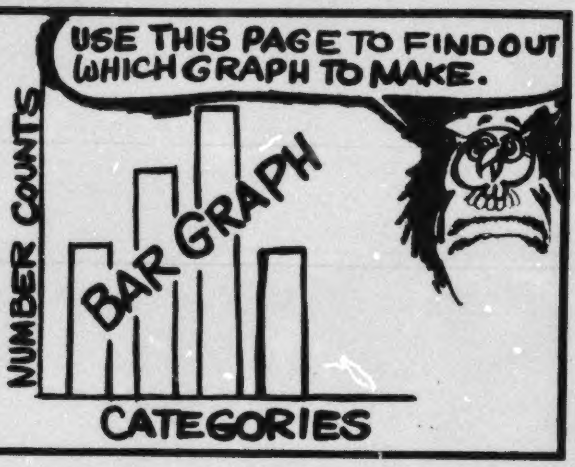


HEIGHT CM	NUMBER OF CHILDREN
113-117	3
118-122	5
123-127	9
128-132	6
133-137	2
138-142	2



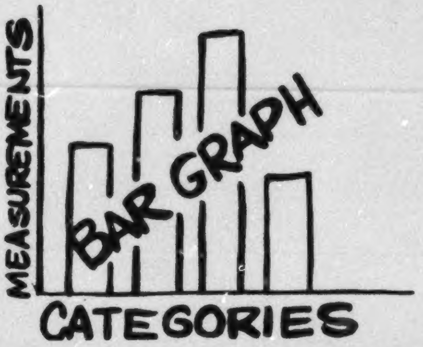
DATA

CATEGORIES	NUMBER COUNTS


USE THIS PAGE TO FIND OUT WHICH GRAPH TO MAKE.
NUMBER COUNTS
BAR GRAPH
CATEGORIES

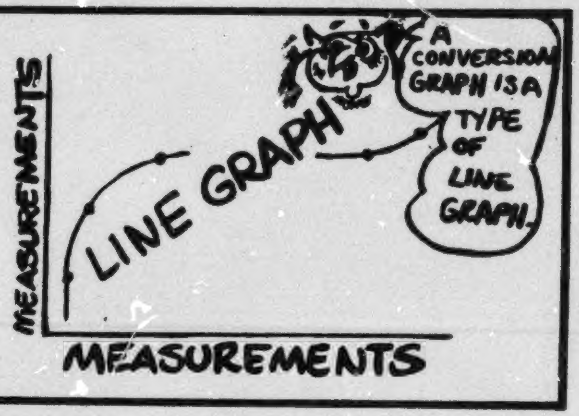
DATA

CATEGORIES	MEASUREMENTS


MEASUREMENTS
BAR GRAPH
CATEGORIES

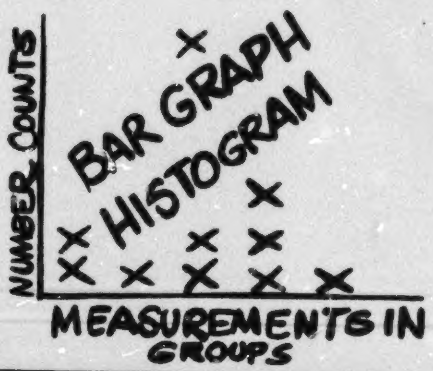
DATA

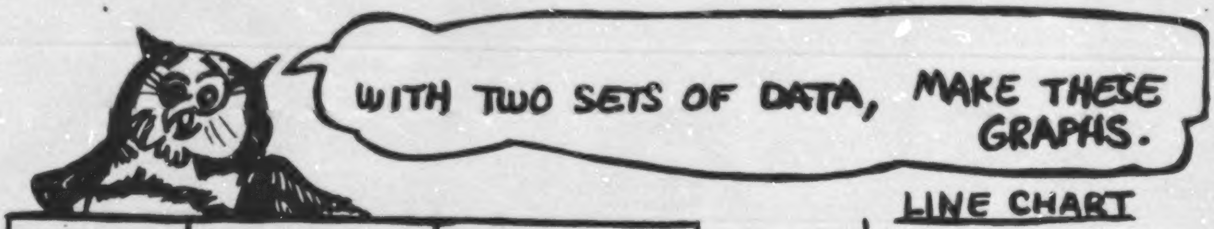
MEASUREMENTS	MEASUREMENTS


A CONVERSION GRAPH IS A TYPE OF LINE GRAPH.
MEASUREMENTS
LINE GRAPH
MEASUREMENTS

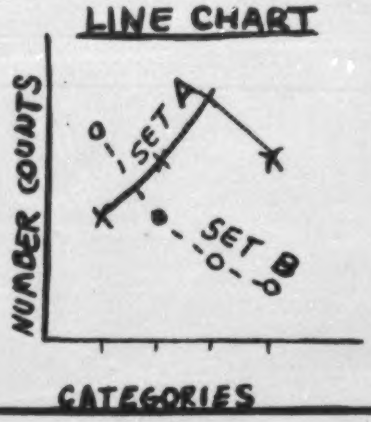
DATA

MEASUREMENTS IN GROUPS	NUMBER COUNTS

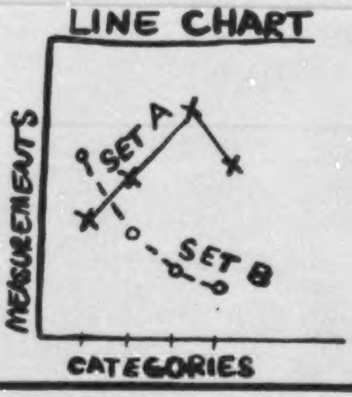

NUMBER COUNTS
BAR GRAPH
HISTOGRAM
MEASUREMENTS IN GROUPS


WITH TWO SETS OF DATA, MAKE THESE GRAPHS.

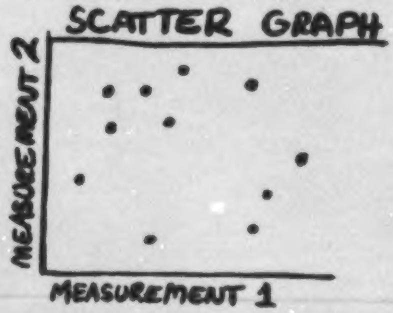
CATEGORIES	NUMBER COUNTS SET A	NUMBER COUNTS SET B



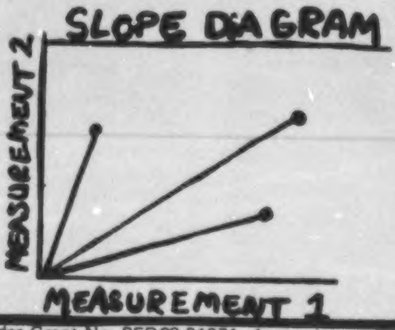
CATEGORIES	MEASUREMENTS SET A	MEASUREMENTS SET B



PEOPLE OR THINGS	ONE TYPE OF MEASUREMENT	ANOTHER TYPE OF MEASUREMENT



OR



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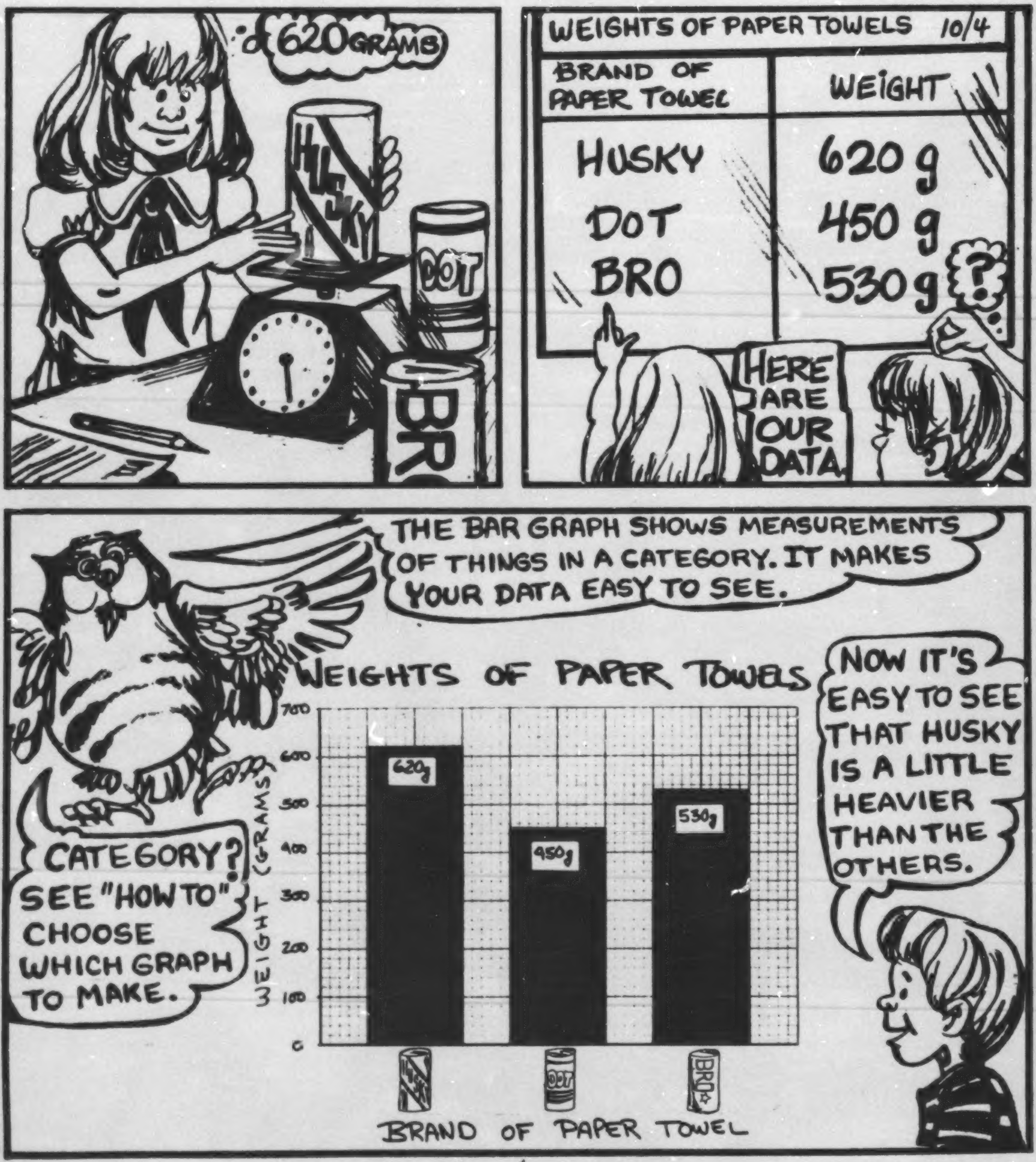
HOW TO
MAKE A BAR GRAPH

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS


620 GRAMS
HUSKY
DOT
BRO
WEIGHTS OF PAPER TOWELS 10/4
BRAND OF PAPER TOWEL
WEIGHT
HUSKY 620 g
DOT 450 g
BRO 530 g
?
HERE ARE OUR DATA
THE BAR GRAPH SHOWS MEASUREMENTS OF THINGS IN A CATEGORY. IT MAKES YOUR DATA EASY TO SEE.
CATEGORY? SEE "HOW TO" CHOOSE WHICH GRAPH TO MAKE.
WEIGHTS OF PAPER TOWELS
WEIGHT (GRAMS)
0
100
200
300
400
500
600
700
620g
450g
530g
HUSKY
DOT
BRO
BRAND OF PAPER TOWEL
NOW IT'S EASY TO SEE THAT HUSKY IS A LITTLE HEAVIER THAN THE OTHERS.

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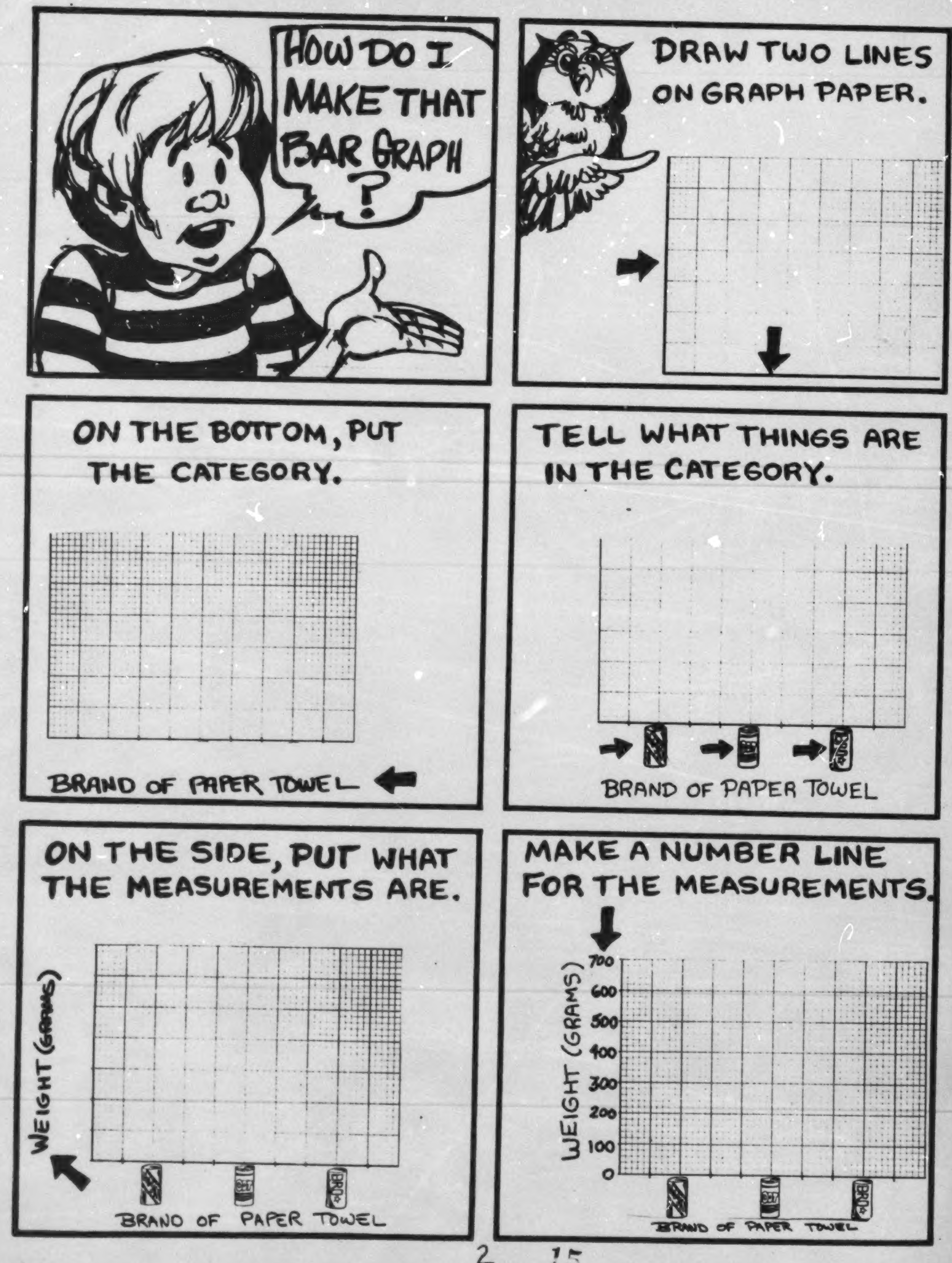
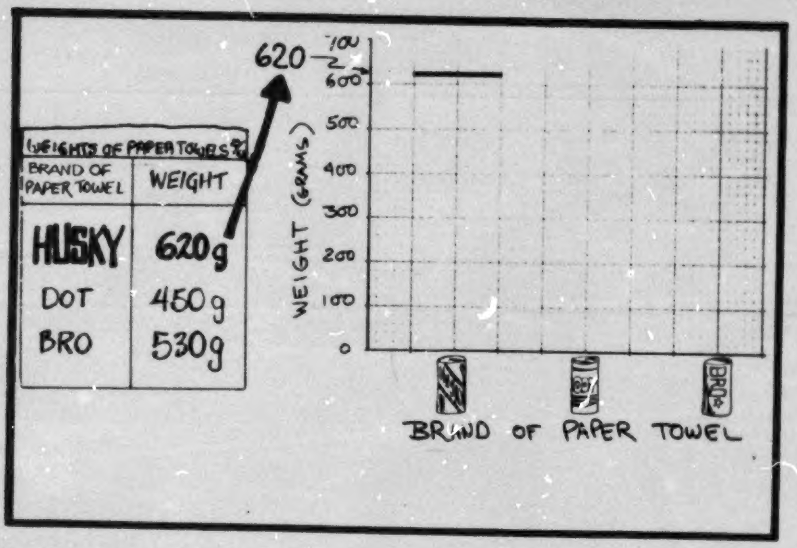
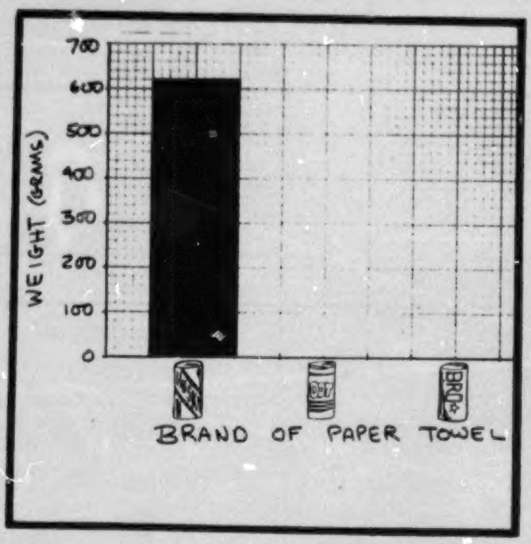
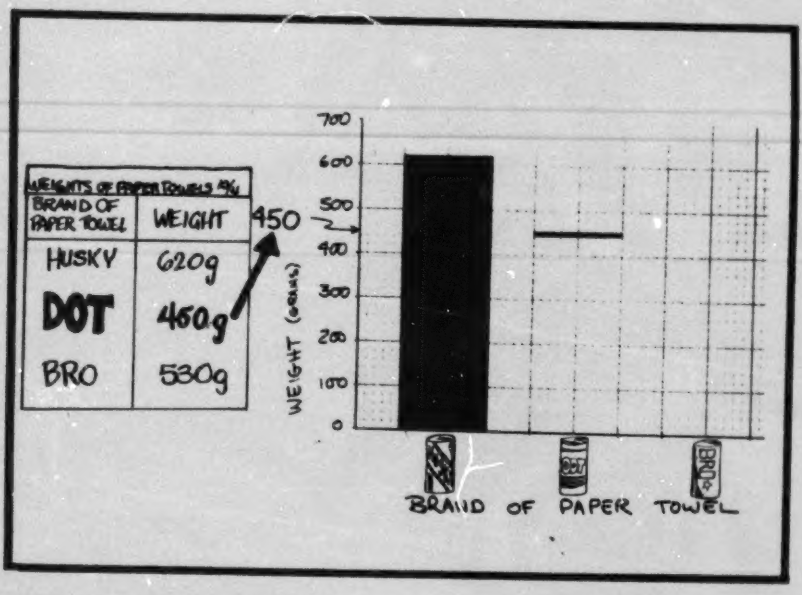

HOW DO I MAKE THAT BAR GRAPH ?
DRAW TWO LINES ON GRAPH PAPER.
ON THE BOTTOM, PUT THE CATEGORY.
BRAND OF PAPER TOWEL
TELL WHAT THINGS ARE IN THE CATEGORY.
BRAND OF PAPER TOWEL
ON THE SIDE, PUT WHAT THE MEASUREMENTS ARE.
WEIGHT (GRAMS)
BRAND OF PAPER TOWEL
MAKE A NUMBER LINE FOR THE MEASUREMENTS.
700
600
500
400
300
200
100
0
WEIGHT (GRAMS)
BRAND OF PAPER TOWEL

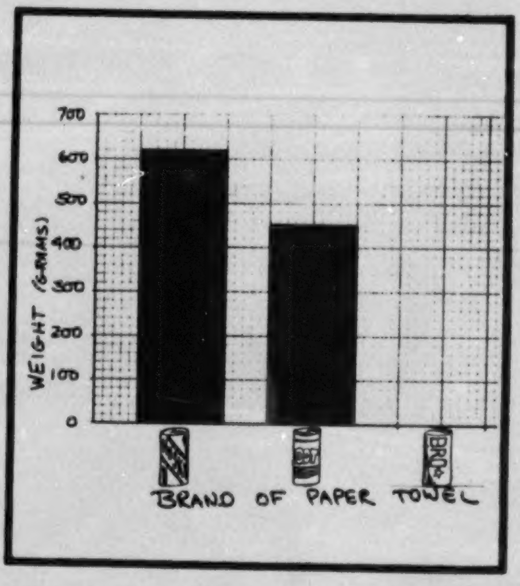


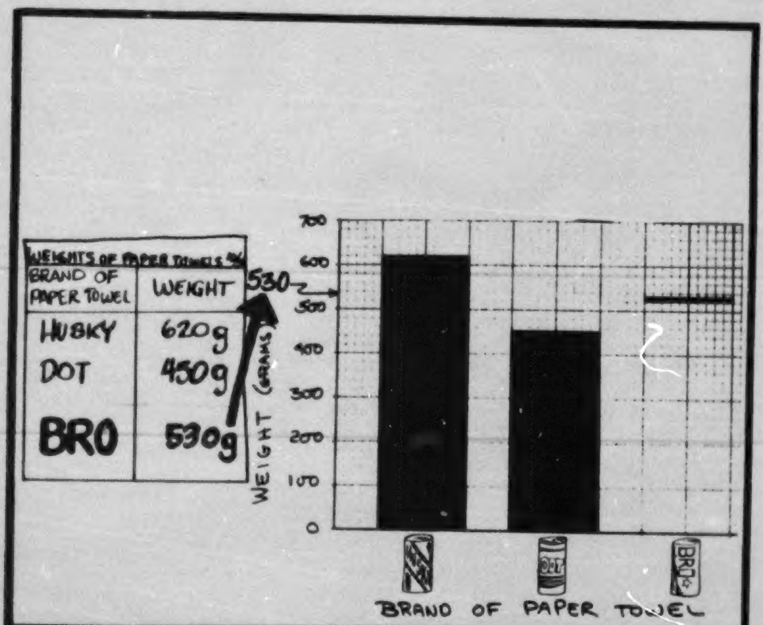
WEIGHTS OF PAPER TOWELS	
BRAND OF PAPER TOWEL	WEIGHT
HUSKY	**620g**
DOT	450g
BRO	530g



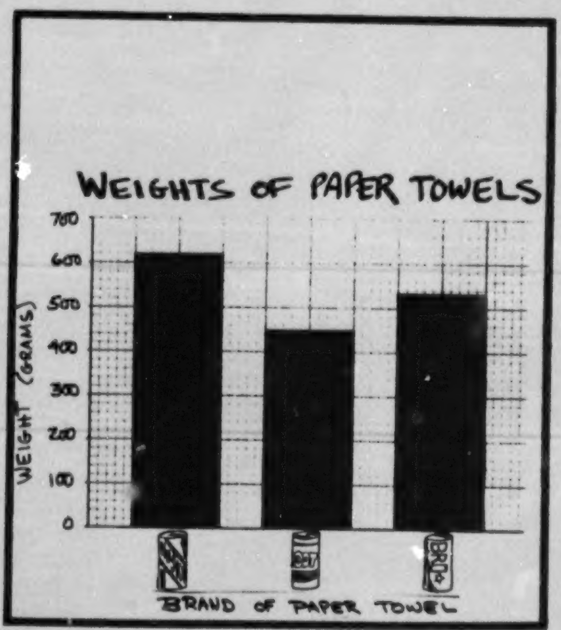


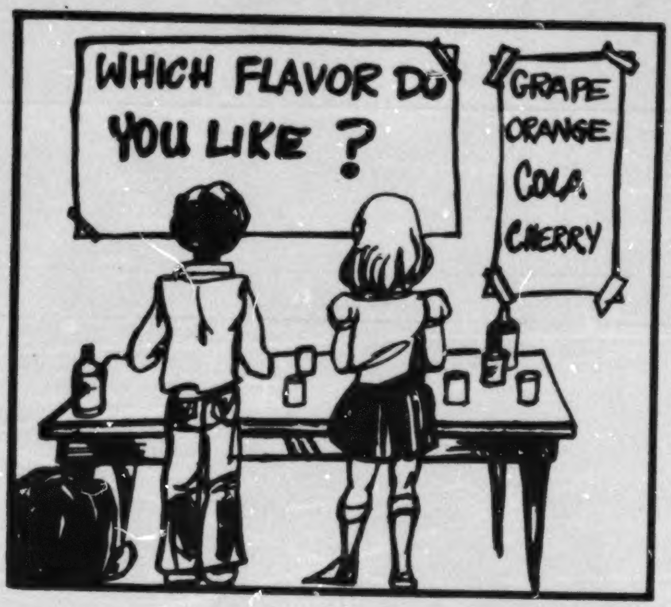
WEIGHTS OF PAPER TOWELS	
BRAND OF PAPER TOWEL	WEIGHT
HUSKY	620g
DOT	**450g**
BRO	530g

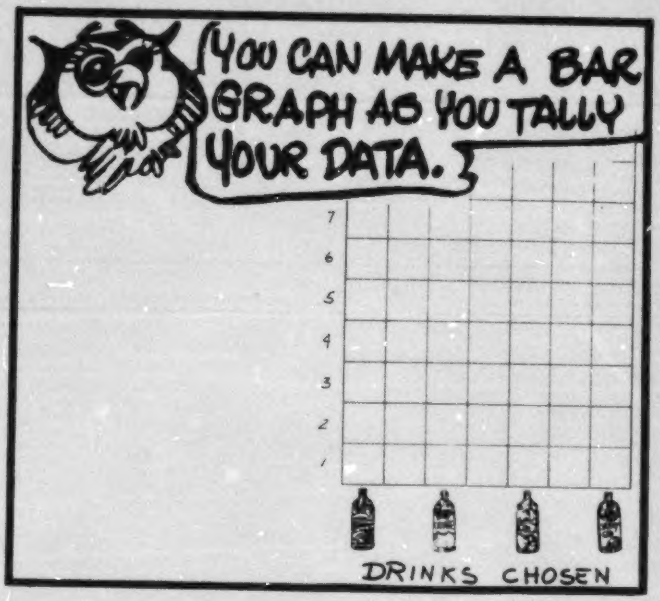


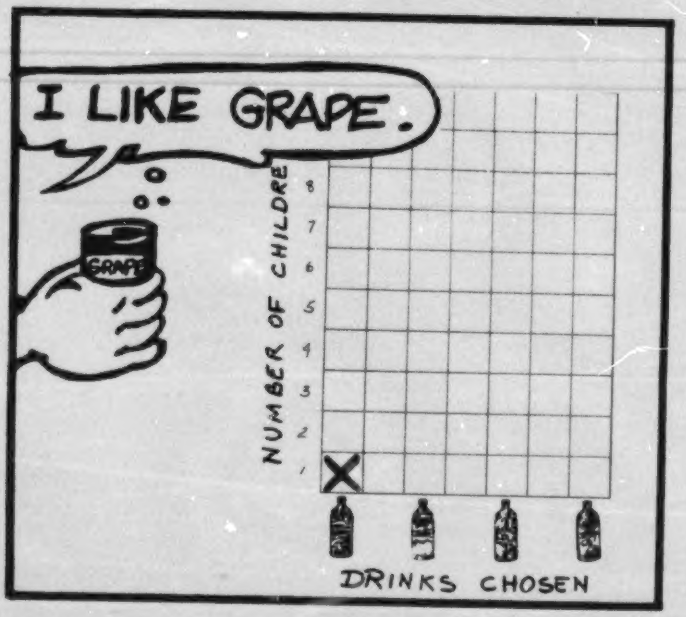


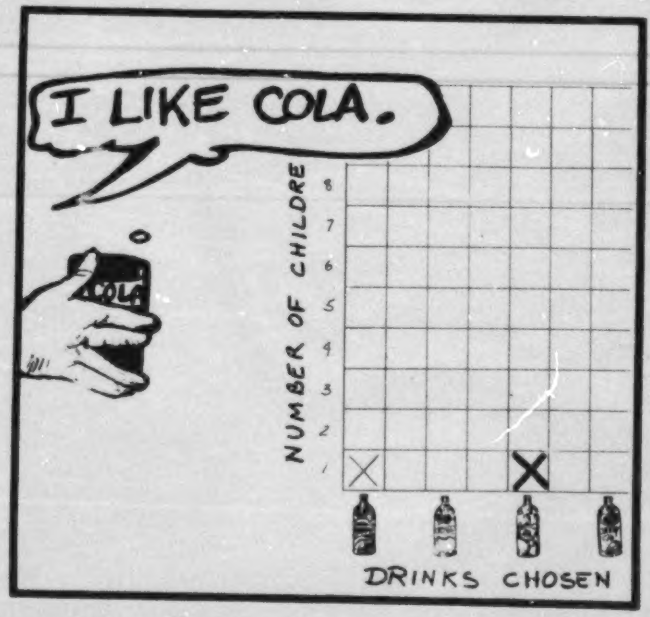
WEIGHTS OF PAPER TOWELS	
BRAND OF PAPER TOWEL	WEIGHT
HUSKY	620g
DOT	450g
BRO	**530g**

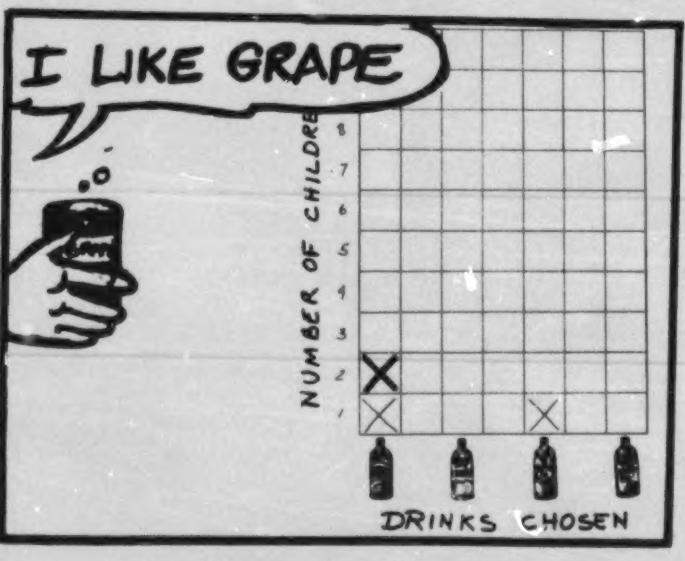


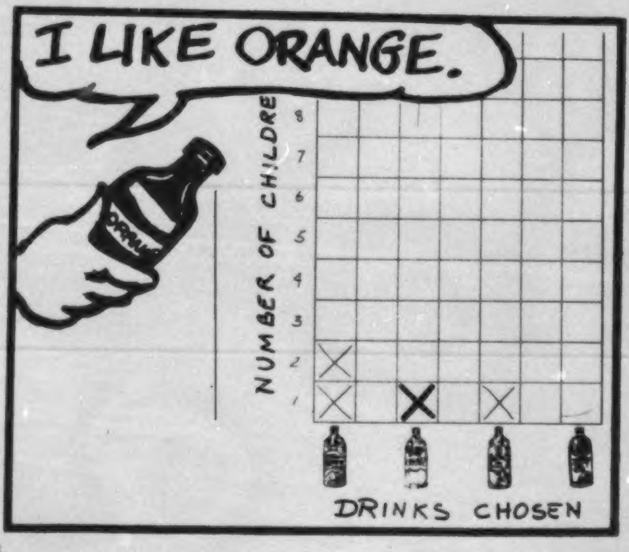

WHICH FLAVOR DO YOU LIKE ?
GRAPE
ORANGE
COLA
CHERRY

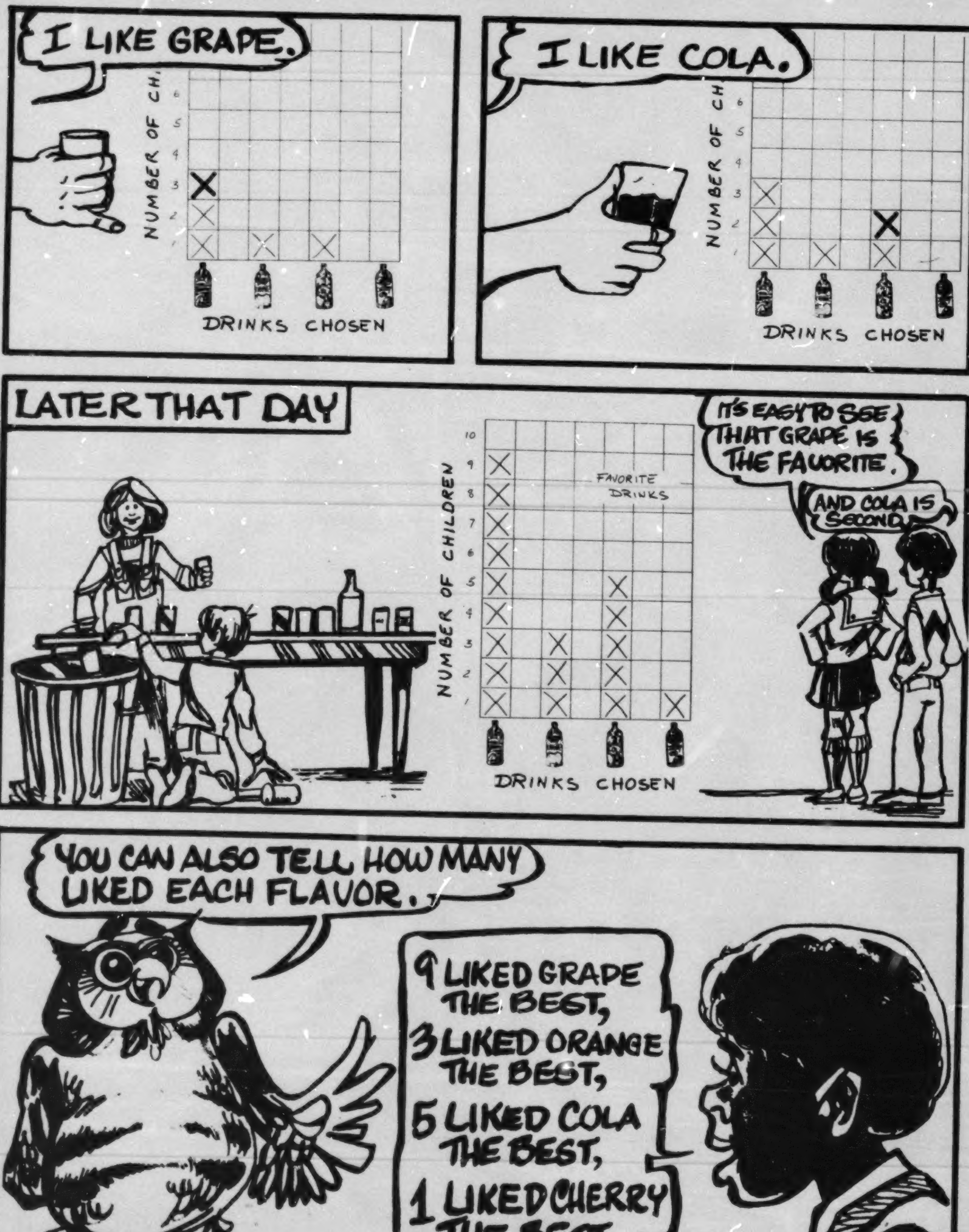

YOU CAN MAKE A BAR GRAPH AS YOU TALLY YOUR DATA.
1
2
3
4
5
6
7
DRINKS CHOSEN

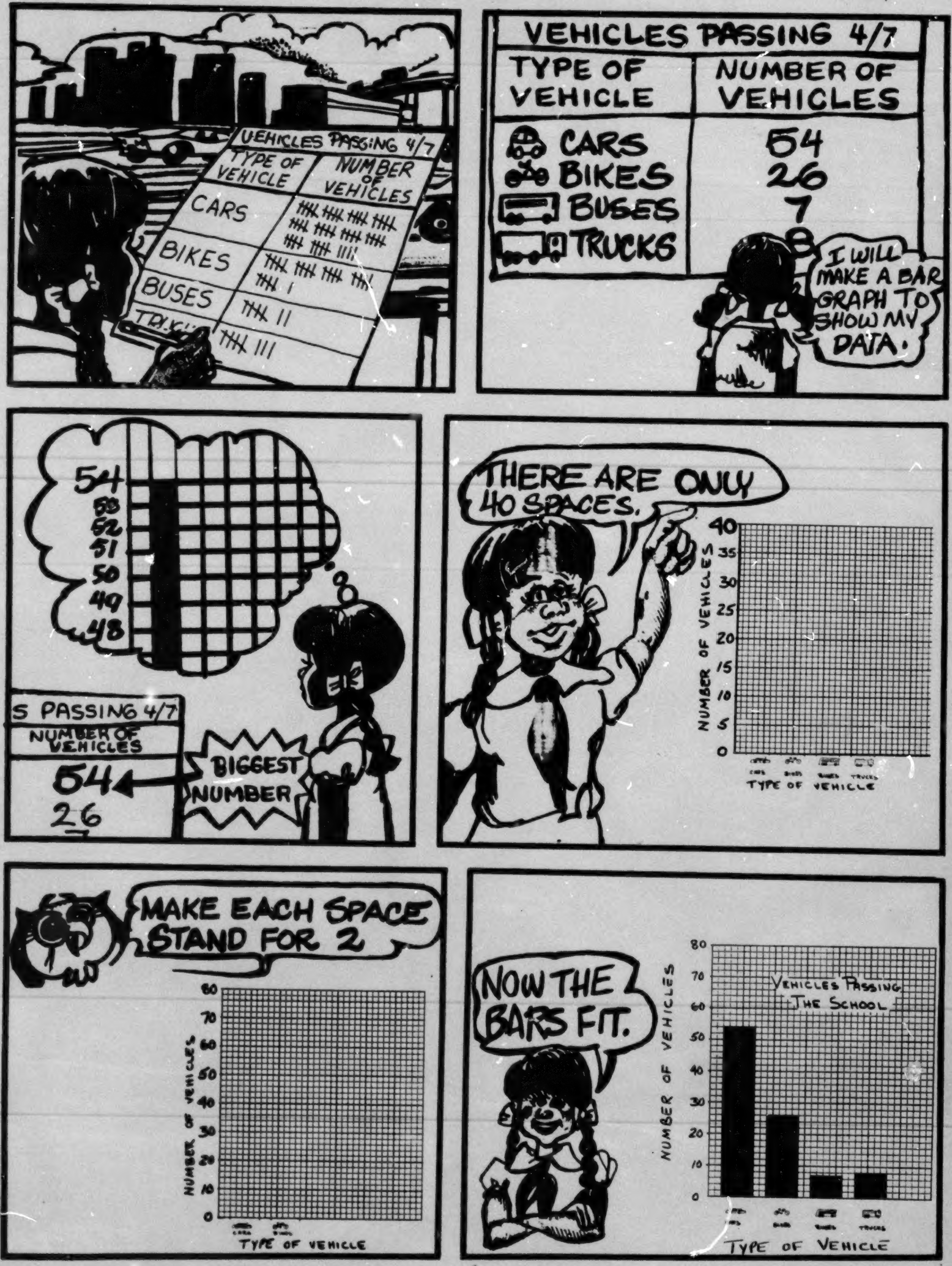

I LIKE GRAPE.
GRAPE
NUMBER OF CHILDRE
1
2
3
4
5
6
7
8
DRINKS CHOSEN


I LIKE COLA.
COLA
NUMBER OF CHILDRE
1
2
3
4
5
6
7
8
DRINKS CHOSEN


I LIKE GRAPE
NUMBER OF CHILDRE
1
2
3
4
5
6
7
8
DRINKS CHOSEN

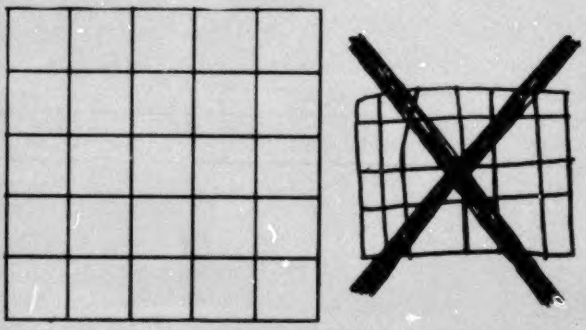

I LIKE ORANGE.
ORANGE
NUMBER OF CHILDRE
1
2
3
4
5
6
7
8
DRINKS CHOSEN


I LIKE GRAPE.
NUMBER OF CH
1 2 3 4 5 6
DRINKS CHOSEN
I LIKE COLA.
NUMBER OF CH
1 2 3 4 5 6
DRINKS CHOSEN
LATER THAT DAY
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9 10
FAVORITE DRINKS
DRINKS CHOSEN
IT'S EASY TO SEE THAT GRAPE IS THE FAVORITE.
AND COLA IS SECOND.
YOU CAN ALSO TELL HOW MANY LIKED EACH FLAVOR.
9 LIKED GRAPE THE BEST, 3 LIKED ORANGE THE BEST, 5 LIKED COLA THE BEST, 1 LIKED CHERRY THE BEST.

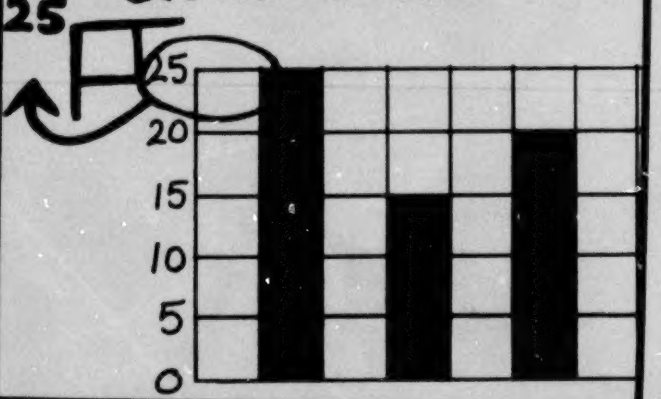

VEHICLES PASSING 4/7
TYPE OF VEHICLE
NUMBER OF VEHICLES
CARS
BIKES
BUSES
TRUCKS
VEHICLES PASSING 4/7
TYPE OF VEHICLE
NUMBER OF VEHICLES
CARS 54
BIKES 26
BUSES 7
TRUCKS 8
I WILL MAKE A BAR GRAPH TO SHOW MY DATA.
54
53
52
51
50
49
48
S PASSING 4/7
NUMBER OF VEHICLES
54
26
BIGGEST NUMBER
THERE ARE ONLY 40 SPACES.
0
5
10
15
20
25
30
35
40
NUMBER OF VEHICLES
CARS
BIKES
BUSES
TRUCKS
TYPE OF VEHICLE
MAKE EACH SPACE STAND FOR 2
0
10
20
30
40
50
60
70
80
NUMBER OF VEHICLES
CARS
BIKES
TYPE OF VEHICLE
NOW THE BARS FIT.
VEHICLES PASSING THE SCHOOL
0
10
20
30
40
50
60
70
80
NUMBER OF VEHICLES
CARS
BIKES
BUSES
TRUCKS
TYPE OF VEHICLE

HERE ARE SOME THINGS TO KEEP IN MIND.

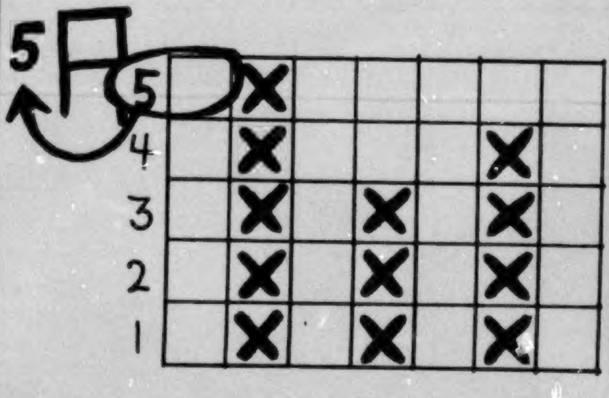
EACH SPACE IS THE SAME SIZE.



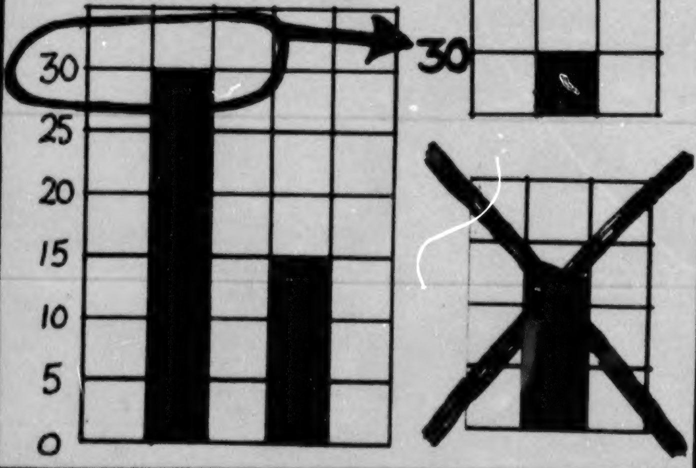
WHEN YOUR BAR GRAPH HAS BARS, PUT THE NUMBERS **ON THE LINES.**


25
25
20
15
10
5
0

WHEN YOUR BAR GRAPH HAS X'S, PUT THE NUMBERS **IN THE SPACES.**

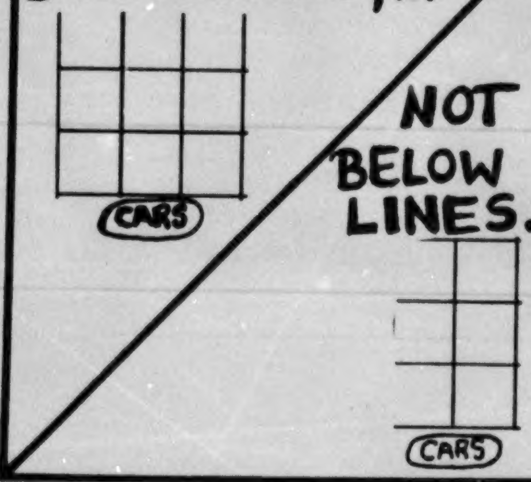


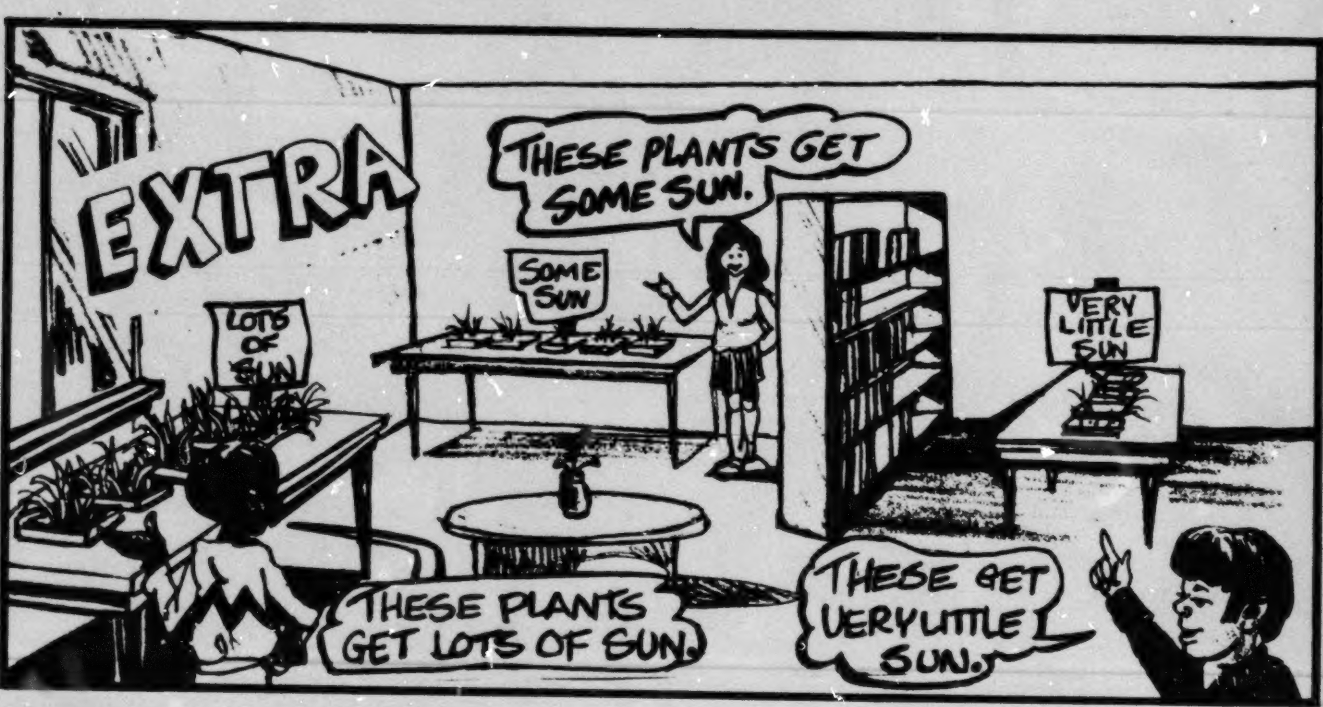
MAKE THE TOP OF EACH BAR STRAIGHT.

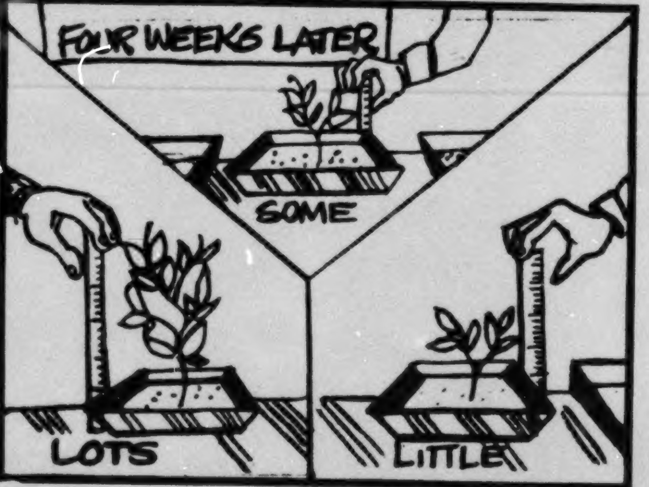

30
30
25
20
15
10
5
0

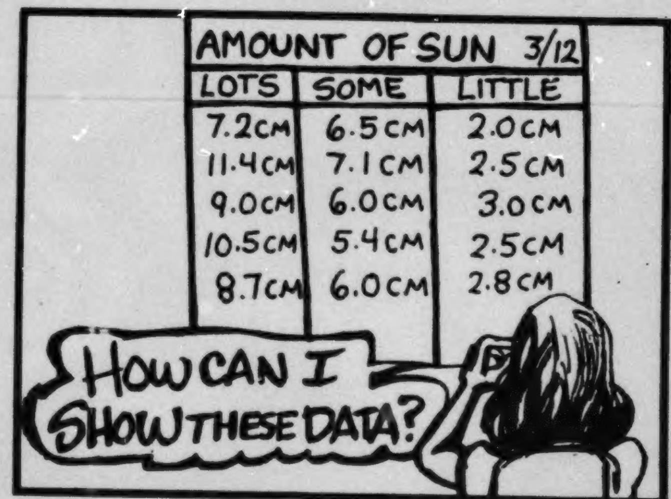
PUT NAMES BELOW SPACES,...

NOT BELOW LINES.



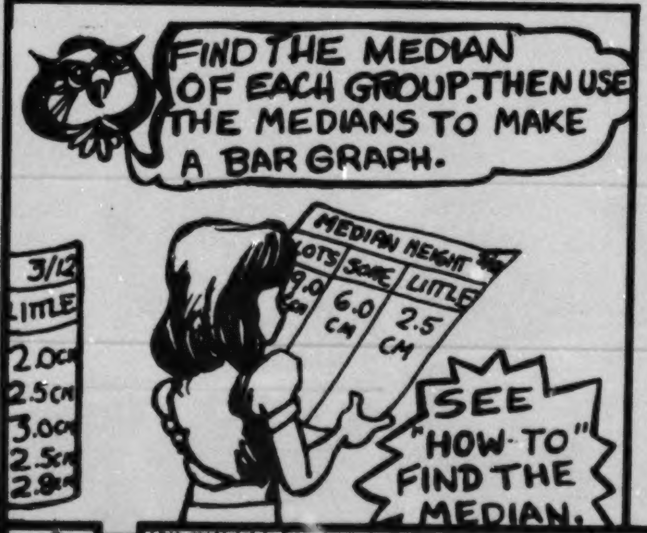

EXTRA
LOTS OF SUN
SOME SUN
VERY LITTLE SUN
THESE PLANTS GET SOME SUN.
THESE PLANTS GET LOTS OF SUN.
THESE GET VERY LITTLE SUN.


FOUR WEEKS LATER
SOME
LOTS
LITTLE



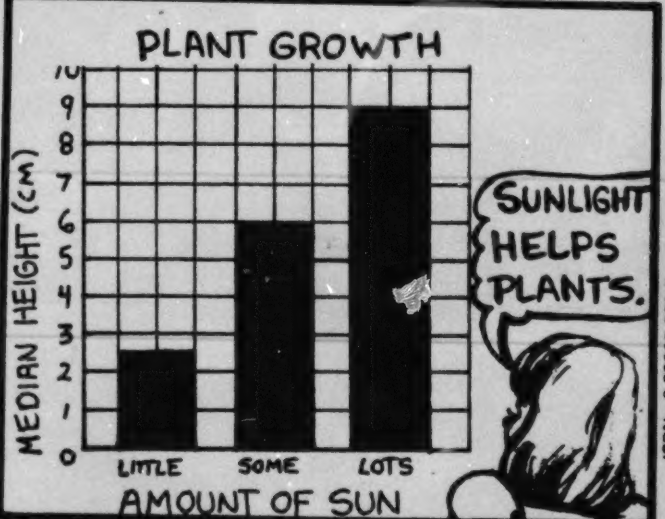
AMOUNT OF SUN 3/12		
LOTS	SOME	LITTLE
7.2CM	6.5CM	2.0CM
11.4CM	7.1CM	2.5CM
9.0CM	6.0CM	3.0CM
10.5CM	5.4CM	2.5CM
8.7CM	6.0CM	2.8CM

HOW CAN I SHOW THESE DATA?


FIND THE MEDIAN OF EACH GROUP. THEN USE THE MEDIANS TO MAKE A BAR GRAPH.
3/12
LITTLE
2.0CM
2.5CM
3.0CM
2.5CM
2.8CM

MEDIAN HEIGHT		
LOTS	SOME	LITTLE
9.0 CM	6.0 CM	2.5 CM

SEE "HOW-TO" FIND THE MEDIAN.



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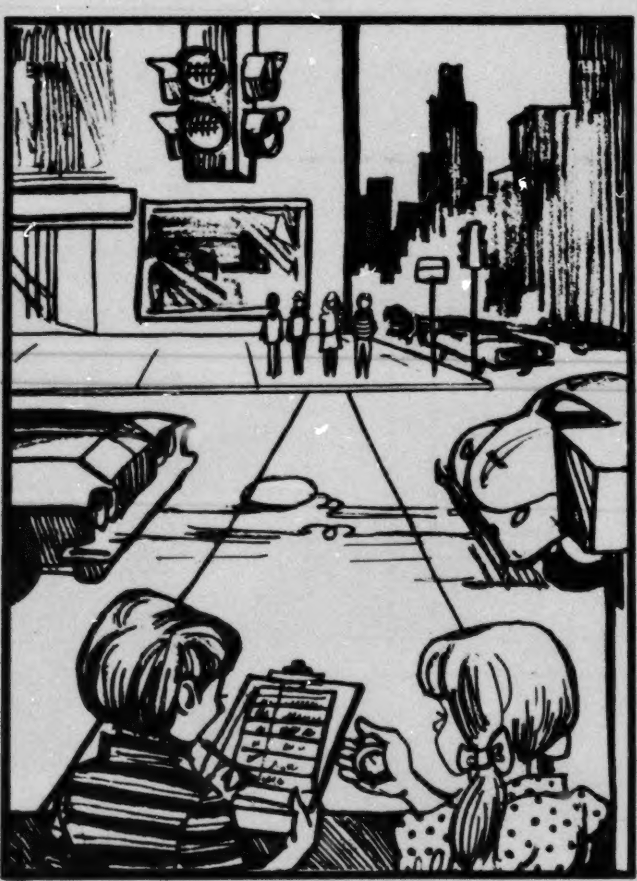
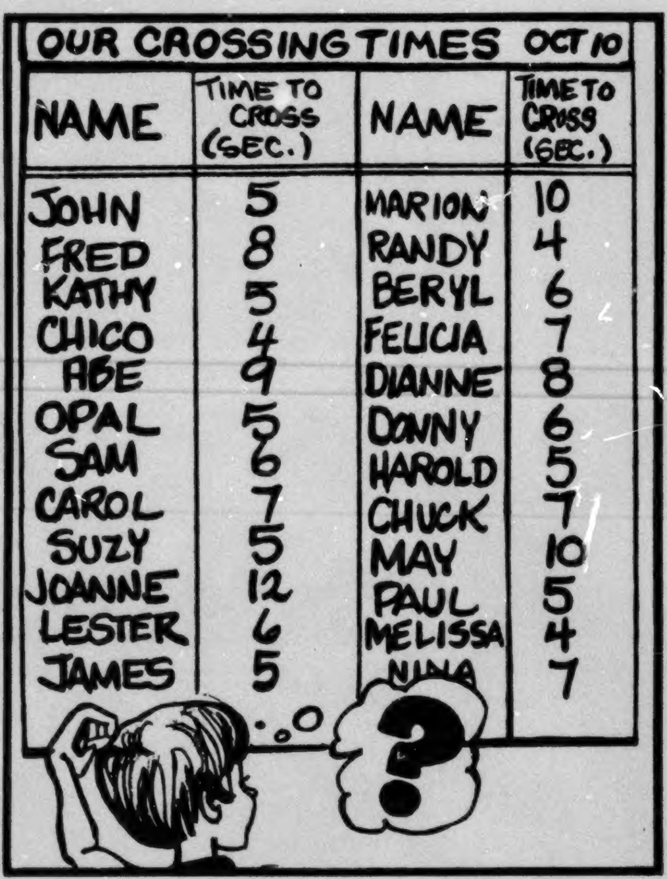
HOW TO

MAKE A BAR GRAPH HISTOGRAM

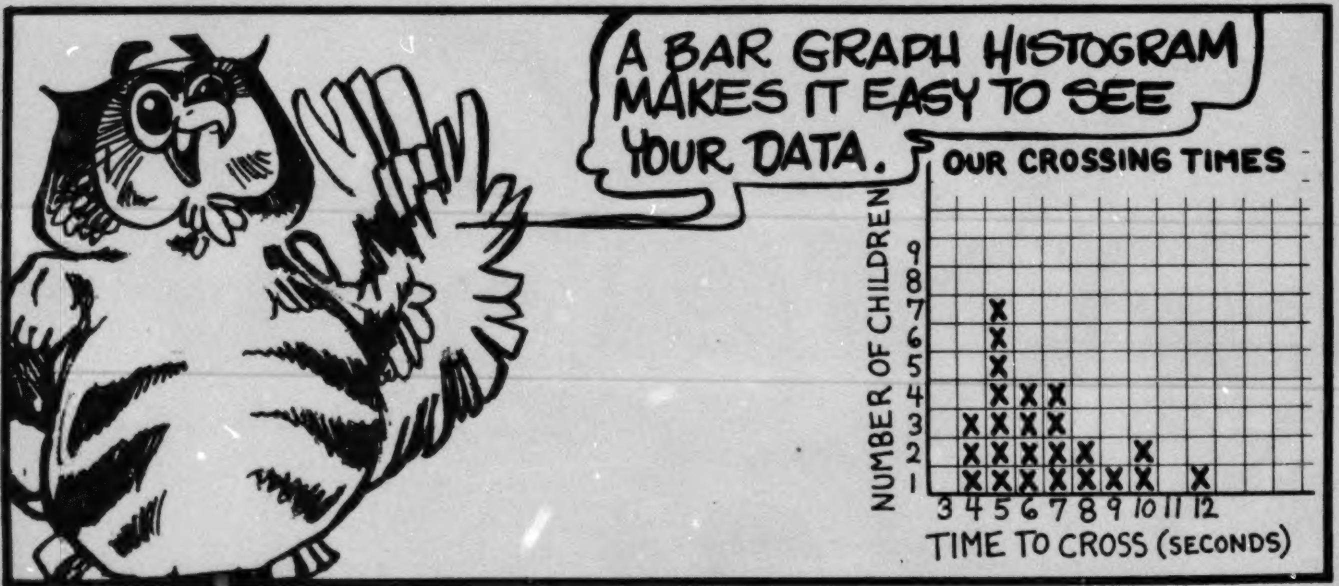
USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS





OUR CROSSING TIMES OCT 10

NAME	TIME TO CROSS (SEC.)	NAME	TIME TO CROSS (SEC.)
JOHN	5	MARION	10
FRED	8	RANDY	4
KATHY	5	BERYL	6
CHICO	4	FELICIA	7
ABE	9	DIANNE	8
OPAL	5	DONNY	6
SAM	6	HAROLD	5
CAROL	7	CHUCK	7
SUZY	5	MAY	10
JOANNE	12	PAUL	5
LESTER	6	MELISSA	4
JAMES	5	NINA	7



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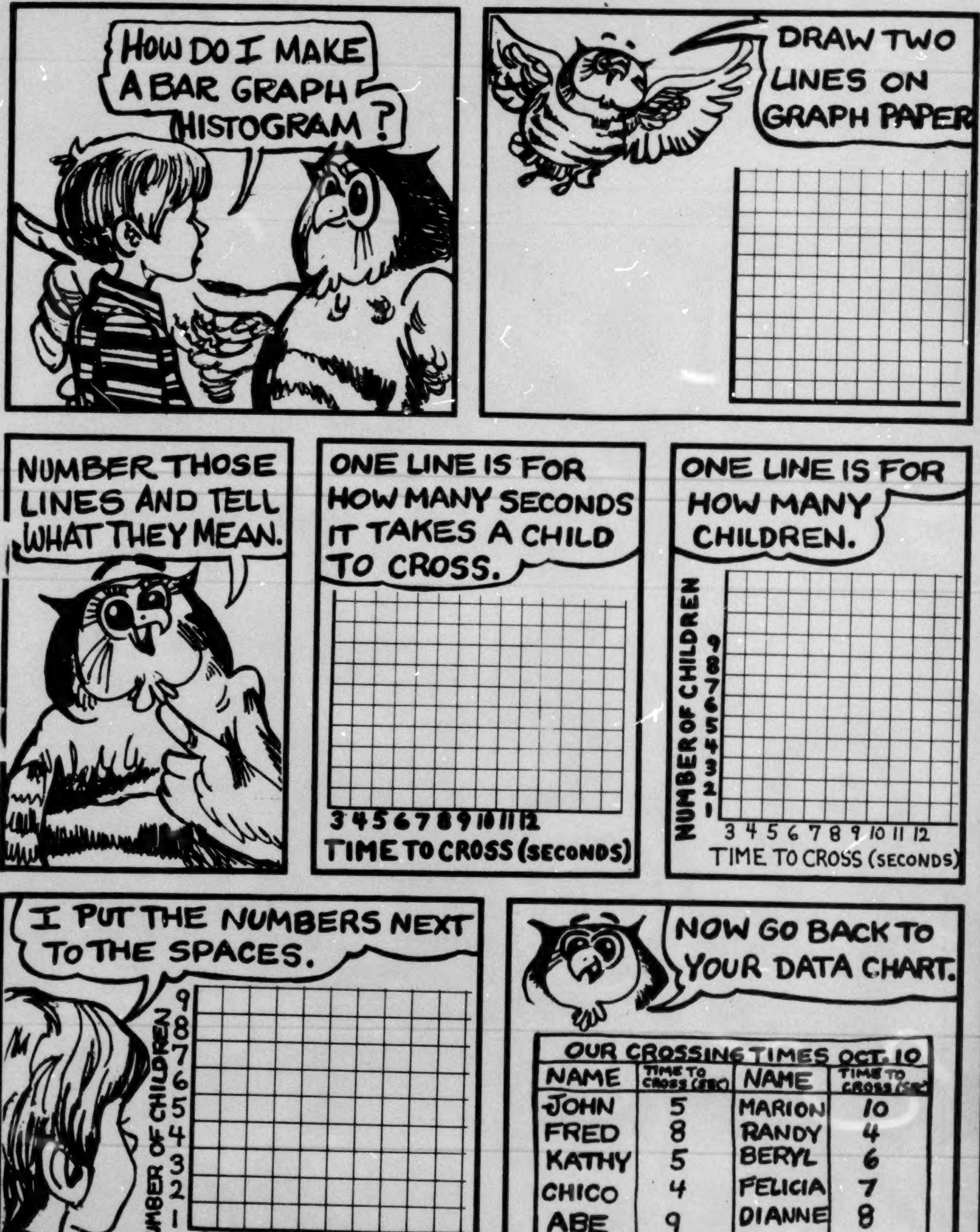
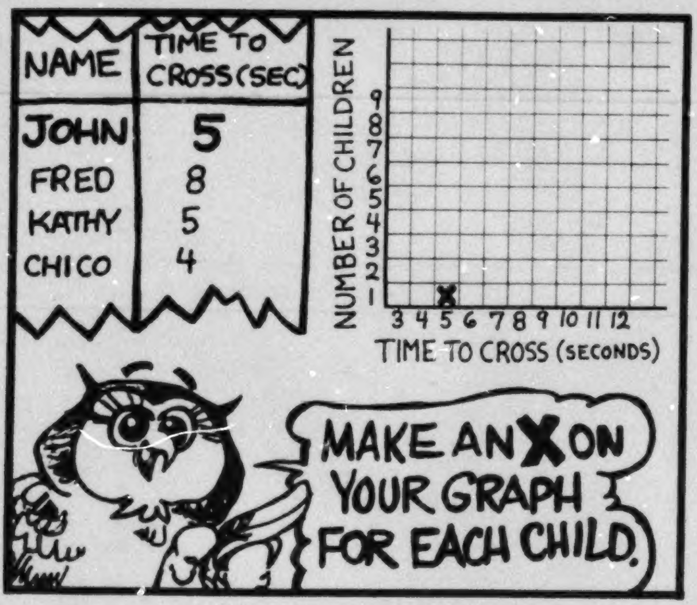

HOW DO I MAKE A BAR GRAPH HISTOGRAM?
DRAW TWO LINES ON GRAPH PAPER.
NUMBER THOSE LINES AND TELL WHAT THEY MEAN.
ONE LINE IS FOR HOW MANY SECONDS IT TAKES A CHILD TO CROSS.
3 4 5 6 7 8 9 10 11 12
TIME TO CROSS (SECONDS)
ONE LINE IS FOR HOW MANY CHILDREN.
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9
3 4 5 6 7 8 9 10 11 12
TIME TO CROSS (SECONDS)
I PUT THE NUMBERS NEXT TO THE SPACES.
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9
3 4 5 6 7 8 9 10 11 12
TIME TO CROSS (SECONDS)
NOW GO BACK TO YOUR DATA CHART.

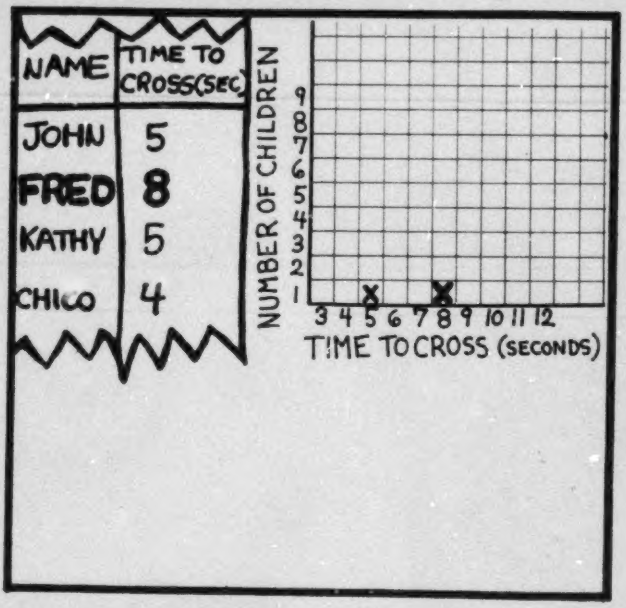
OUR CROSSING TIMES OCT. 10

NAME	TIME TO CROSS (SEC)	NAME	TIME TO CROSS (SEC)
JOHN	5	MARION	10
FRED	8	RANDY	4
KATHY	5	BERYL	6
CHICO	4	FELICIA	7
ABE	9	DIANNE	8
OPAL	5	DONNY	6



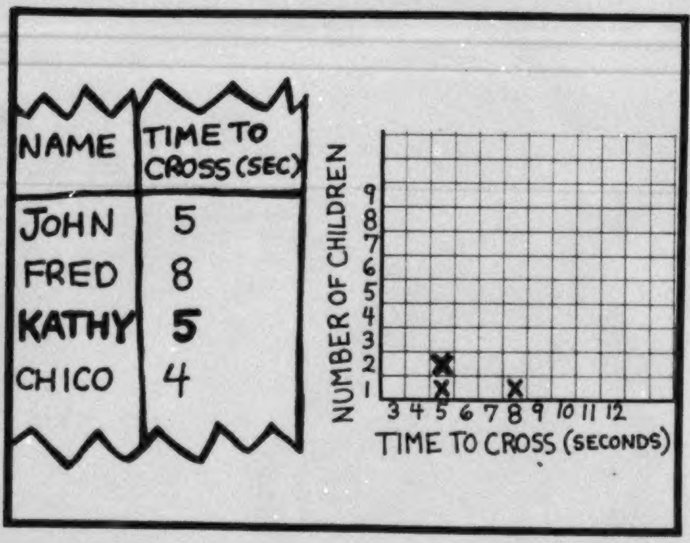
NAME	TIME TO CROSS (SEC)
JOHN	**5**
FRED	8
KATHY	5
CHICO	4

NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9
3 4 5 6 7 8 9 10 11 12
X
TIME TO CROSS (SECONDS)
MAKE AN X ON YOUR GRAPH FOR EACH CHILD.



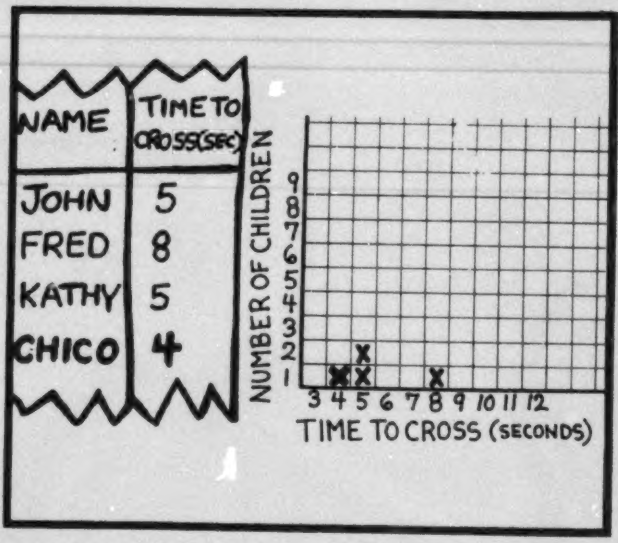
NAME	TIME TO CROSS (SEC)
JOHN	5
FRED	**8**
KATHY	5
CHICO	4

NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9
3 4 5 6 7 8 9 10 11 12
X X
TIME TO CROSS (SECONDS)



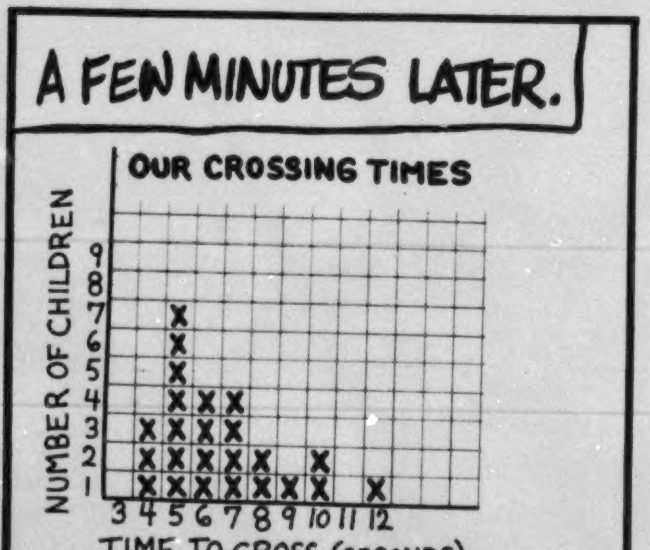
NAME	TIME TO CROSS (SEC)
JOHN	5
FRED	8
KATHY	**5**
CHICO	4

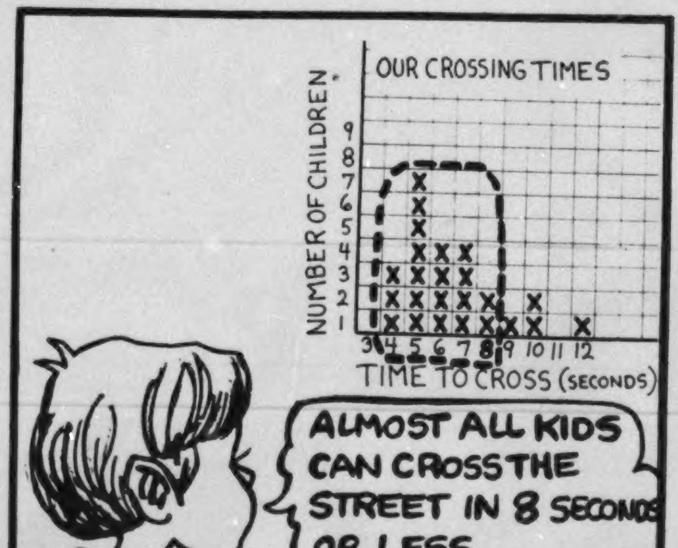
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9
3 4 5 6 7 8 9 10 11 12
X X X
TIME TO CROSS (SECONDS)



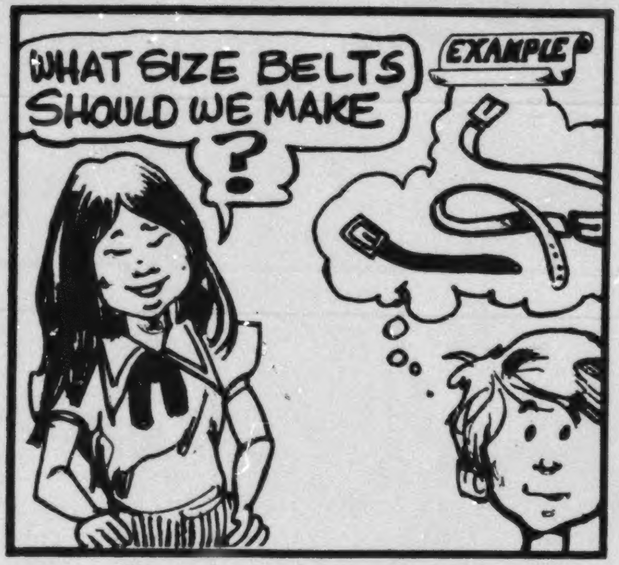
NAME	TIME TO CROSS (SEC)
JOHN	5
FRED	8
KATHY	5
CHICO	**4**

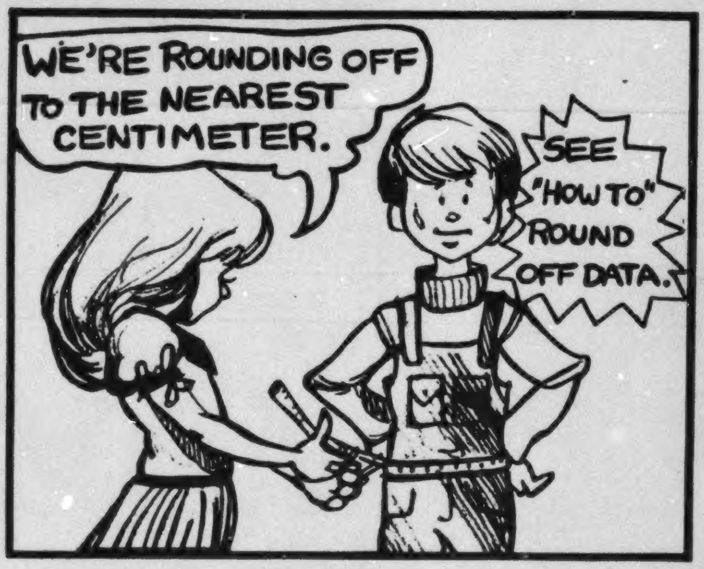
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9
3 4 5 6 7 8 9 10 11 12
X X X X
TIME TO CROSS (SECONDS)

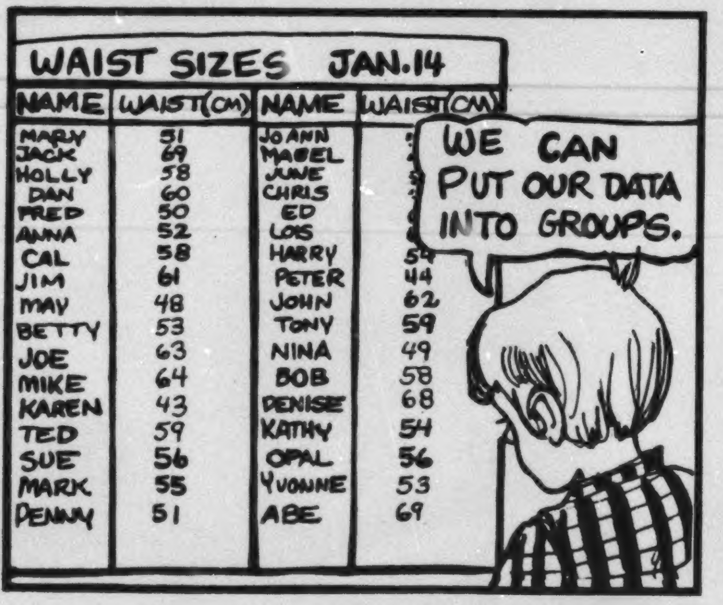




OUR CROSSING TIMES
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9
3 4 5 6 7 8 9 10 11 12
TIME TO CROSS (SECONDS)
ALMOST ALL KIDS CAN CROSS THE STREET IN 8 SECONDS OR LESS.

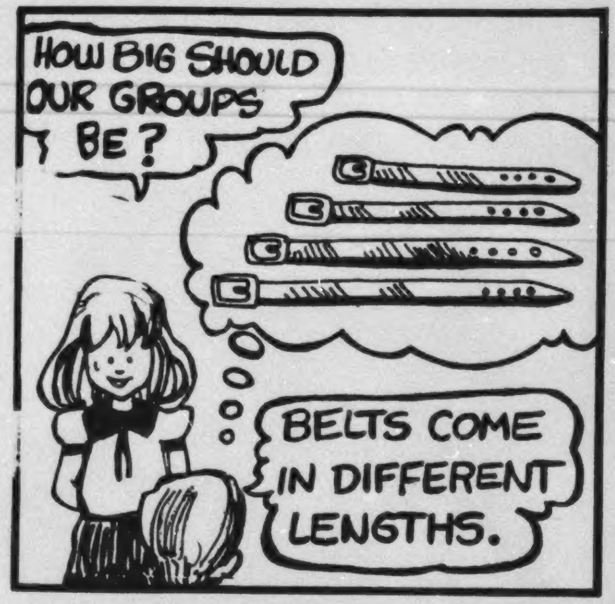

WHAT SIZE BELTS SHOULD WE MAKE?
EXAMPLE

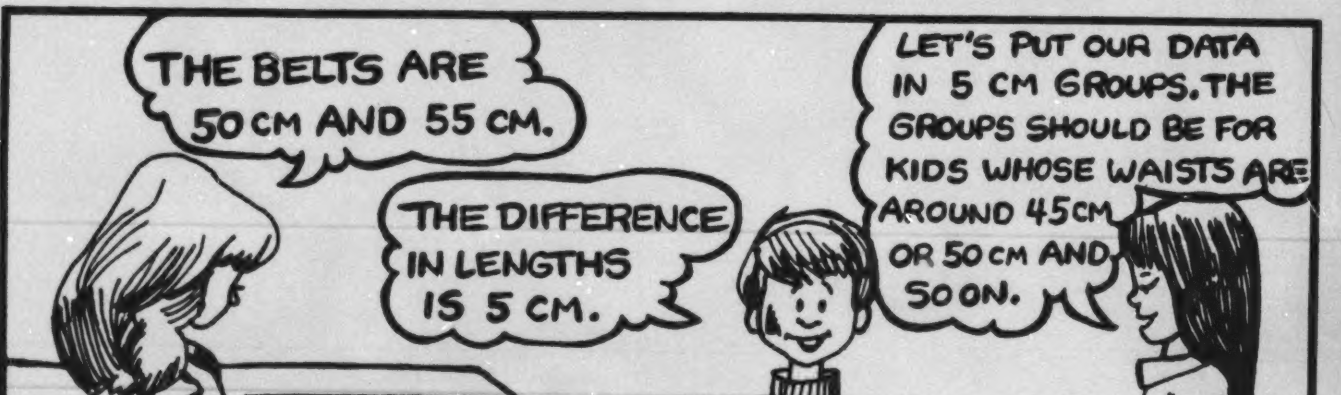

WE'RE ROUNDING OFF TO THE NEAREST CENTIMETER.
SEE "HOW TO" ROUND OFF DATA.

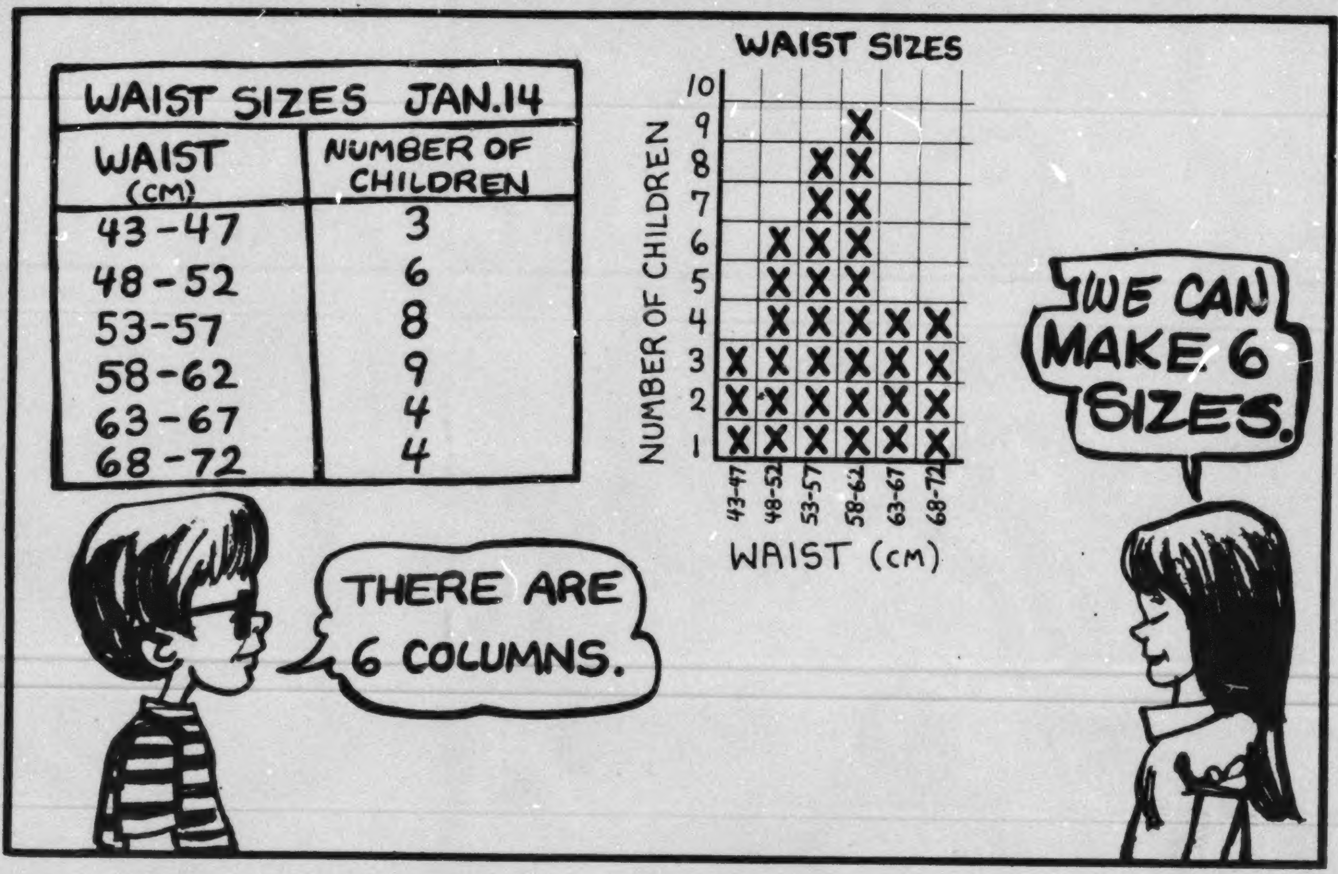

WE CAN PUT OUR DATA INTO GROUPS.

WAIST SIZES JAN. 14

NAME	WAIST (CM)	NAME	WAIST (CM)
MARY	51	JOANN	[illegible]
JACK	69	MABEL	[illegible]
HOLLY	58	JUNE	[illegible]
DAN	60	CHRIS	[illegible]
FRED	50	ED	[illegible]
ANNA	52	LOIS	[illegible]
CAL	58	HARRY	54
JIM	61	PETER	44
MAY	48	JOHN	62
BETTY	53	TONY	59
JOE	63	NINA	49
MIKE	64	BOB	58
KAREN	43	DENISE	68
TED	59	KATHY	54
SUE	56	OPAL	56
MARK	55	YVONNE	53
PENNY	51	ABE	69

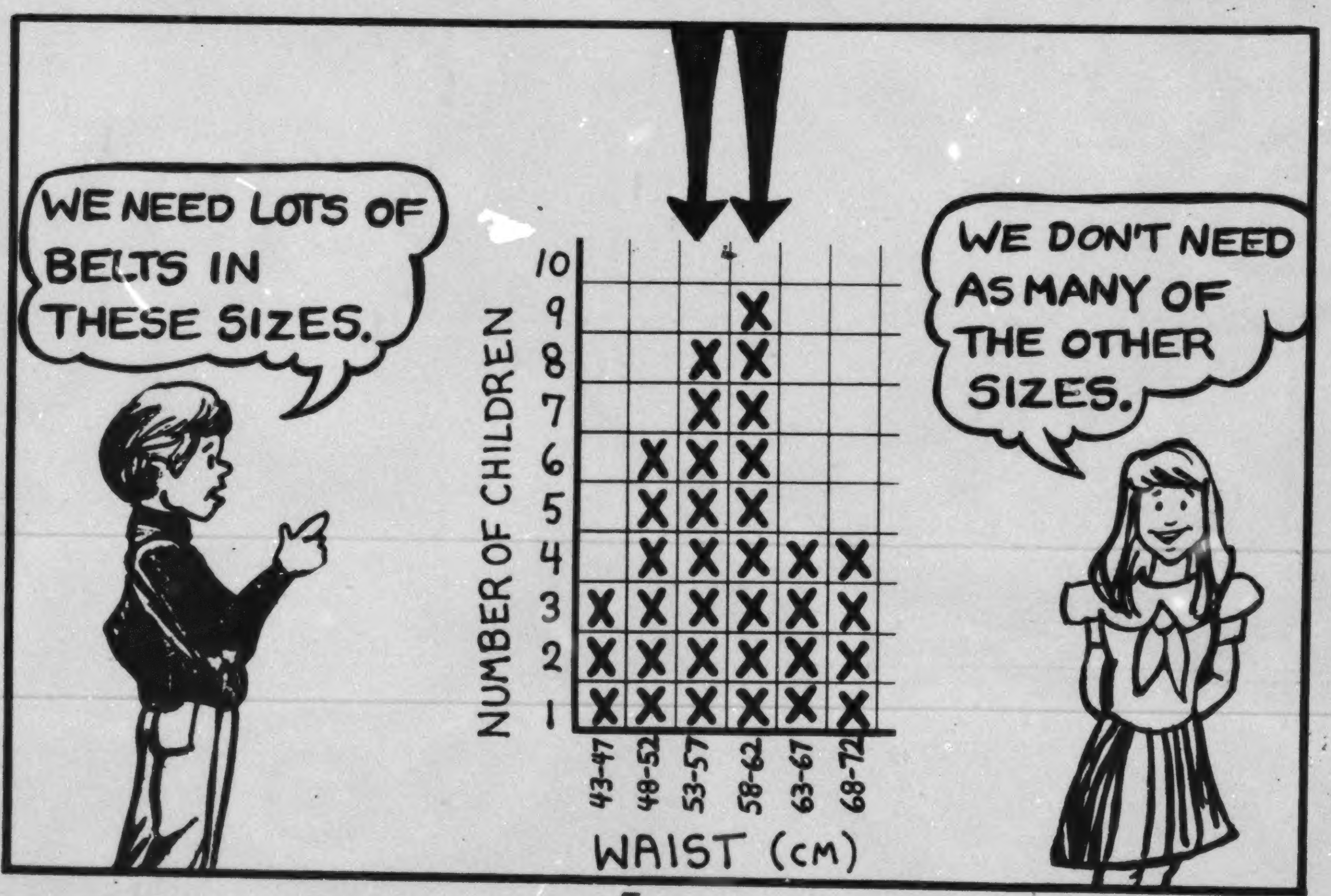

HOW BIG SHOULD OUR GROUPS BE?
BELTS COME IN DIFFERENT LENGTHS.


THE BELTS ARE 50 CM AND 55 CM.
THE DIFFERENCE IN LENGTHS IS 5 CM.
LET'S PUT OUR DATA IN 5 CM GROUPS. THE GROUPS SHOULD BE FOR KIDS WHOSE WAISTS ARE AROUND 45 CM OR 50 CM AND SO ON.

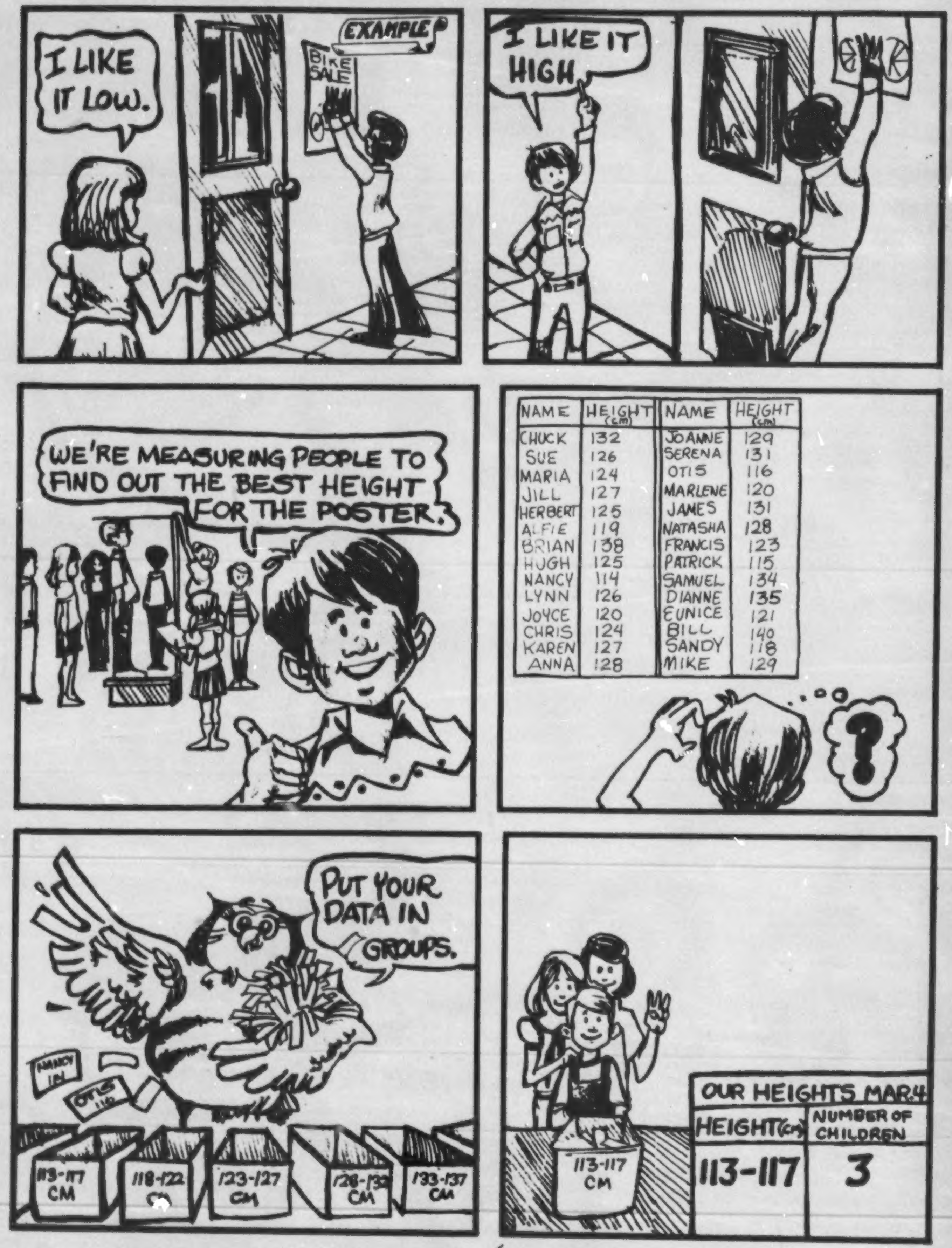


WAIST SIZES JAN.14	
WAIST (CM)	NUMBER OF CHILDREN
43-47	3
48-52	6
53-57	8
58-62	9
63-67	4
68-72	4

WAIST SIZES
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9 10
43-47 48-52 53-57 58-62 63-67 68-72
WAIST (CM)
WE CAN MAKE 6 SIZES.
THERE ARE 6 COLUMNS.



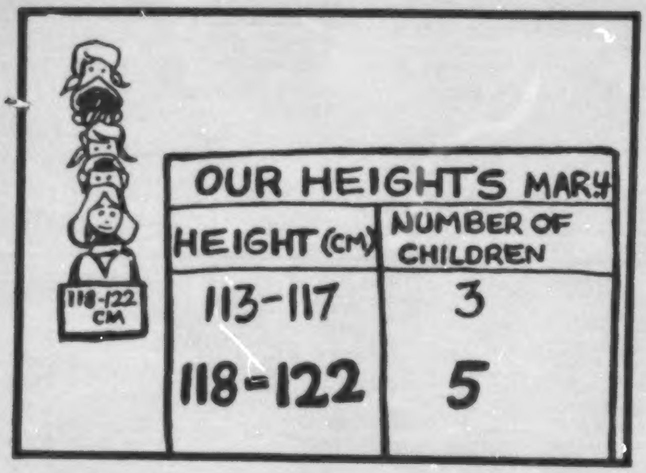
WE NEED LOTS OF BELTS IN THESE SIZES.
NUMBER OF CHILDREN
1 2 3 4 5 6 7 8 9 10
43-47 48-52 53-57 58-62 63-67 68-72
WAIST (CM)
WE DON'T NEED AS MANY OF THE OTHER SIZES.


I LIKE IT LOW.
EXAMPLE
BIKE SALE
I LIKE IT HIGH
WE'RE MEASURING PEOPLE TO FIND OUT THE BEST HEIGHT FOR THE POSTER.
?
PUT YOUR DATA IN GROUPS.
NANCY 114
OTIS 116
113-117 CM
118-122 CM
123-127 CM
128-132 CM
133-137 CM
113-117 CM

NAME	HEIGHT (cm)	NAME	HEIGHT (cm)
CHUCK	132	JOANNE	129
SUE	126	SERENA	131
MARIA	124	OTIS	116
JILL	127	MARLENE	120
HERBERT	125	JAMES	131
ALFIE	119	NATASHA	128
BRIAN	138	FRANCIS	123
HUGH	125	PATRICK	115
NANCY	114	SAMUEL	134
LYNN	126	DIANNE	135
JOYCE	120	EUNICE	121
CHRIS	124	BILL	140
KAREN	127	SANDY	118
ANNA	128	MIKE	129

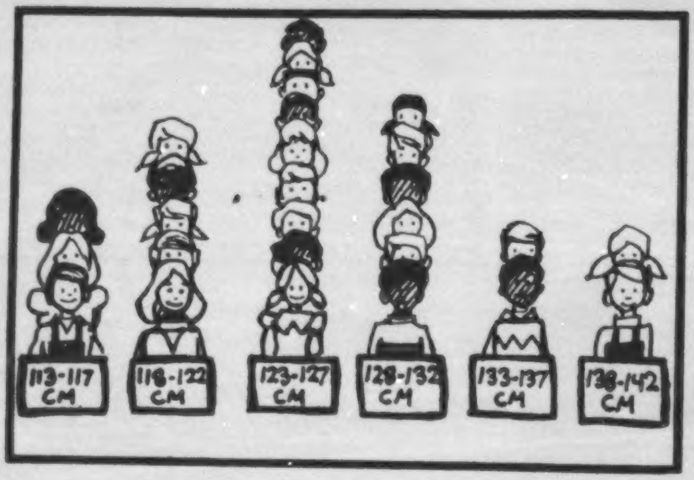
OUR HEIGHTS MAR.4

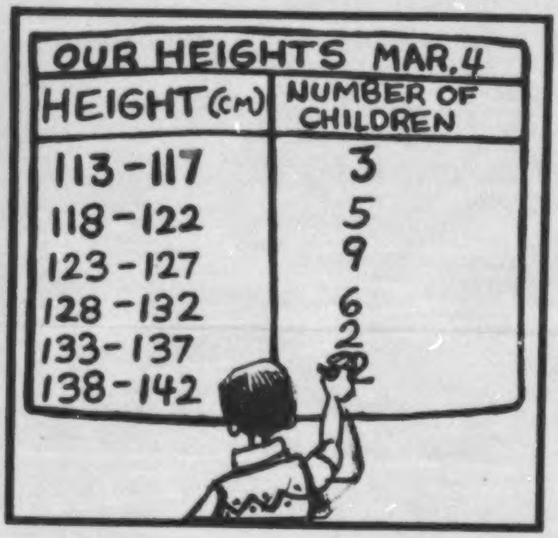
HEIGHT (cm)	NUMBER OF CHILDREN
113-117	3



OUR HEIGHTS MAR.4

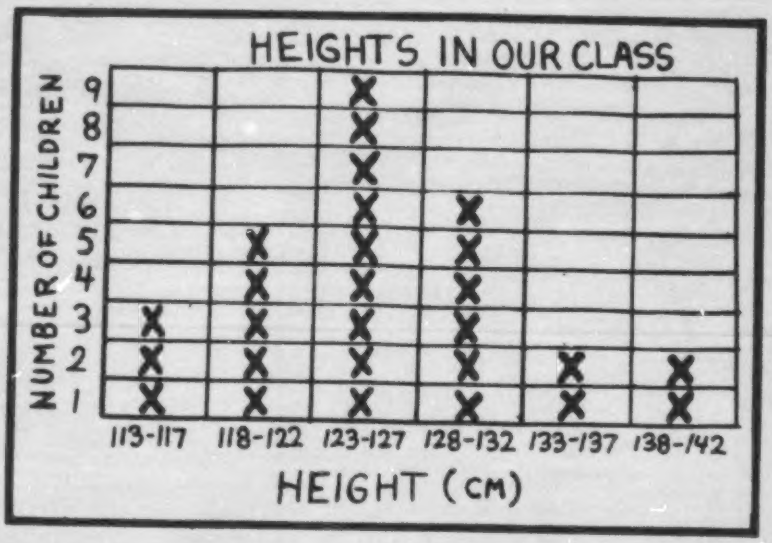
HEIGHT (CM)	NUMBER OF CHILDREN
113-117	3
118-122	5

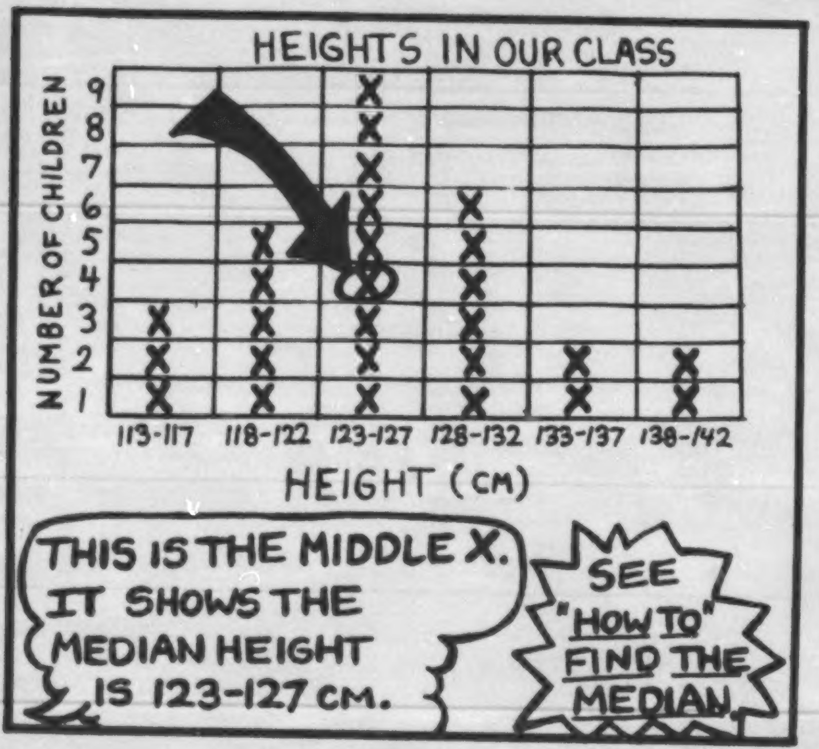

113-117 CM
118-122 CM
123-127 CM
128-132 CM
133-137 CM
138-142 CM

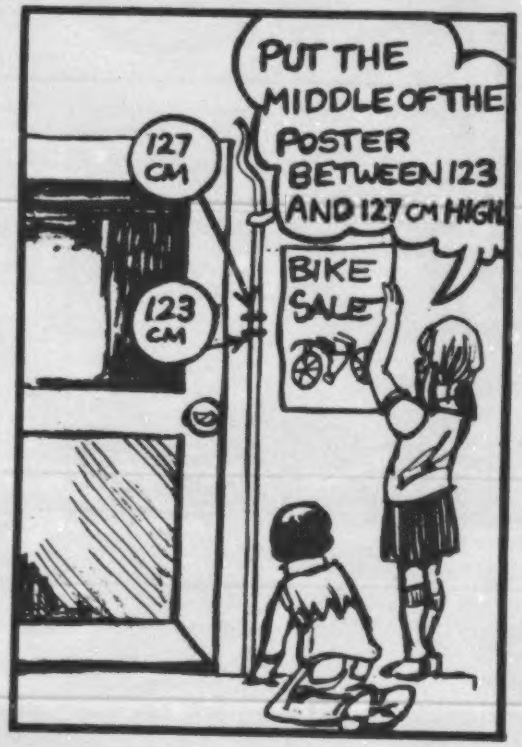


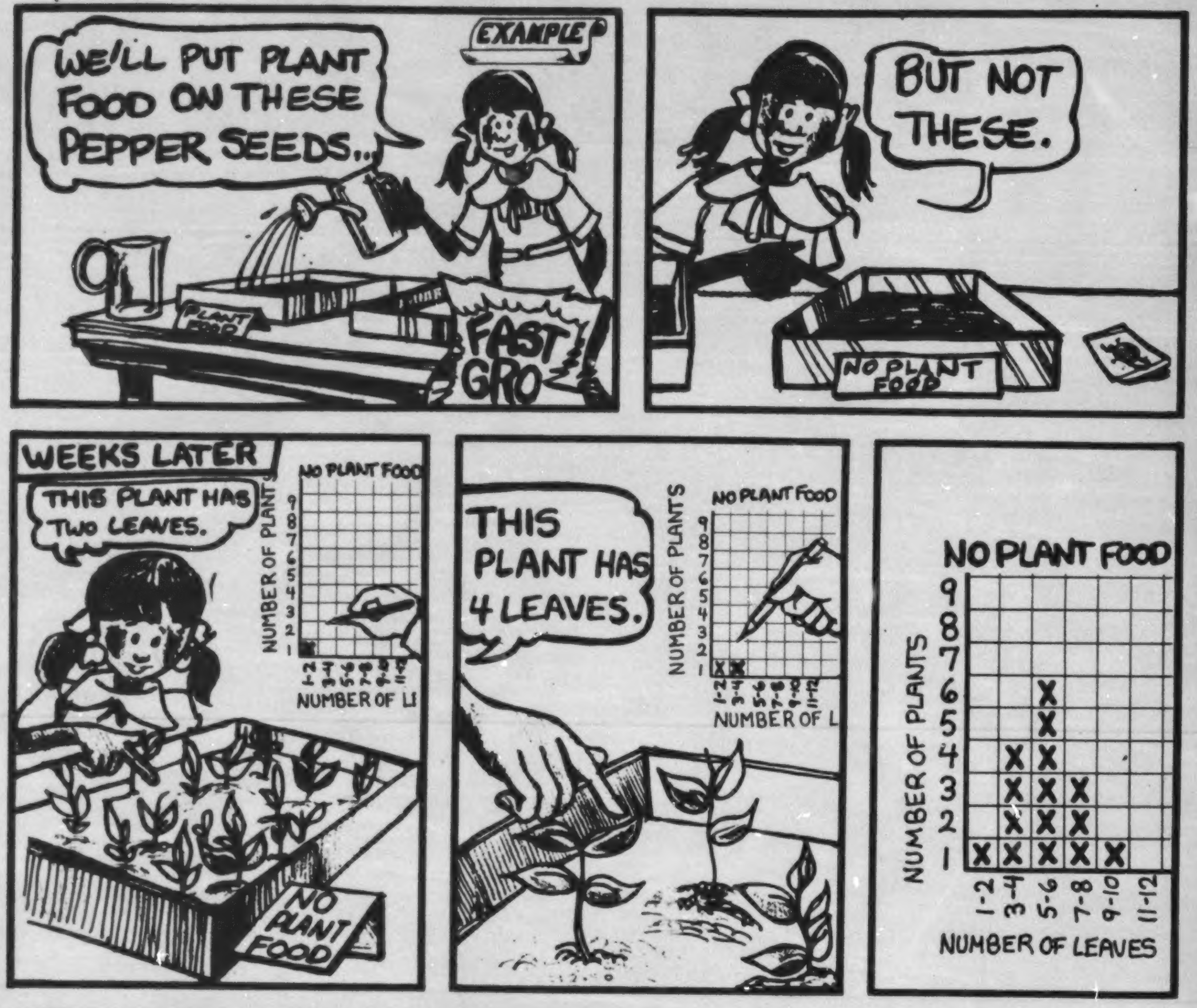
OUR HEIGHTS MAR. 4

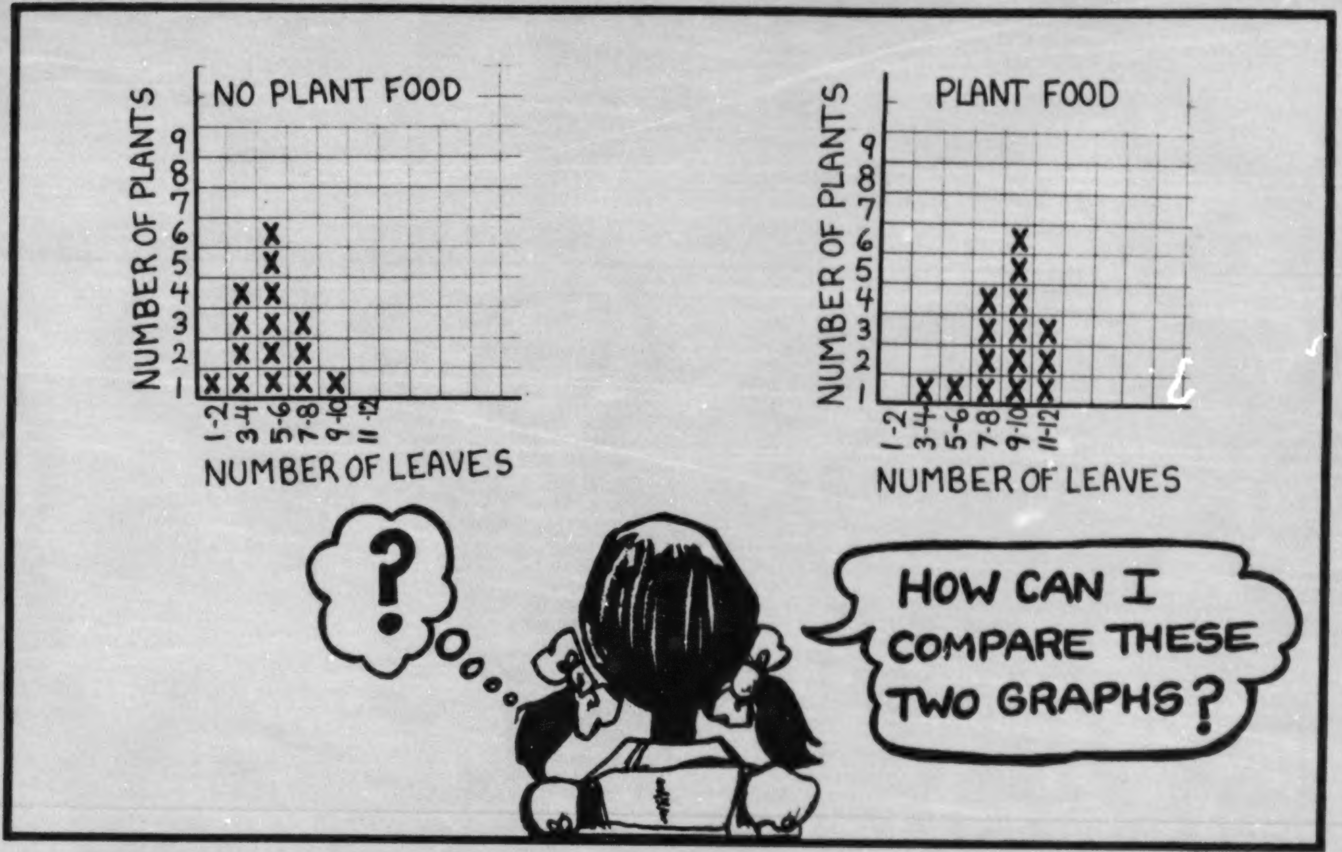
HEIGHT (CM)	NUMBER OF CHILDREN
113-117	3
118-122	5
123-127	9
128-132	6
133-137	2
138-142	2

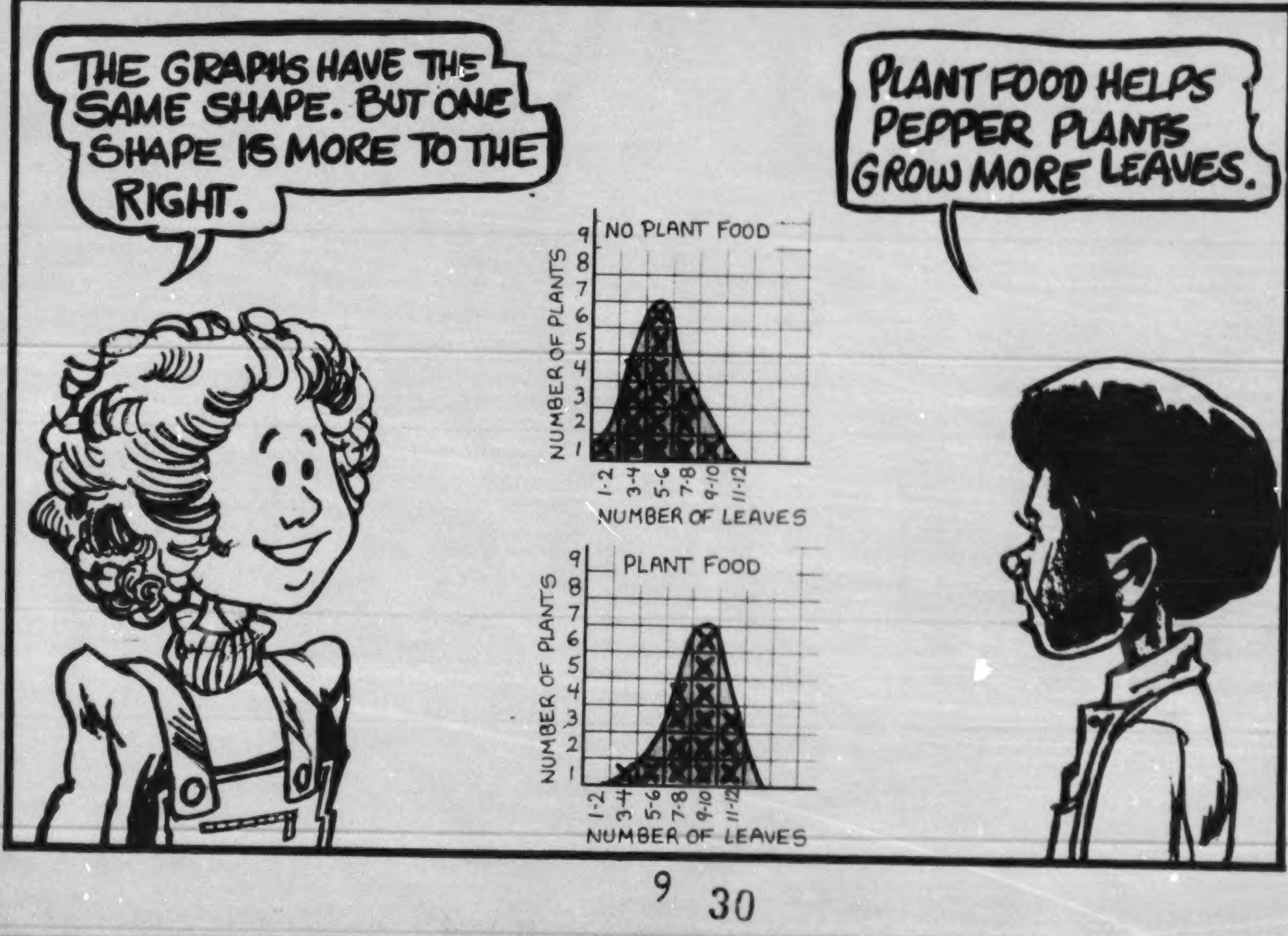


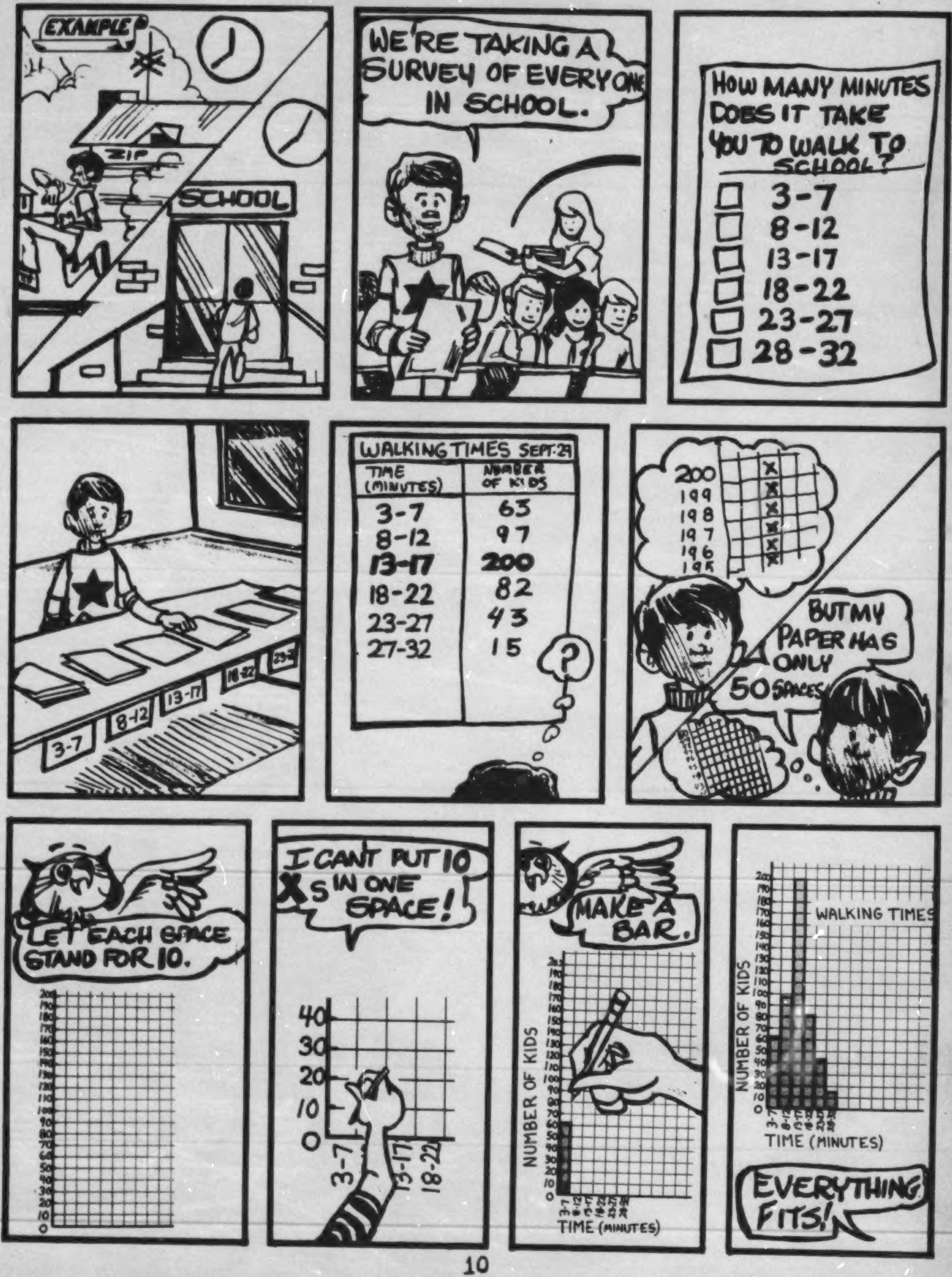


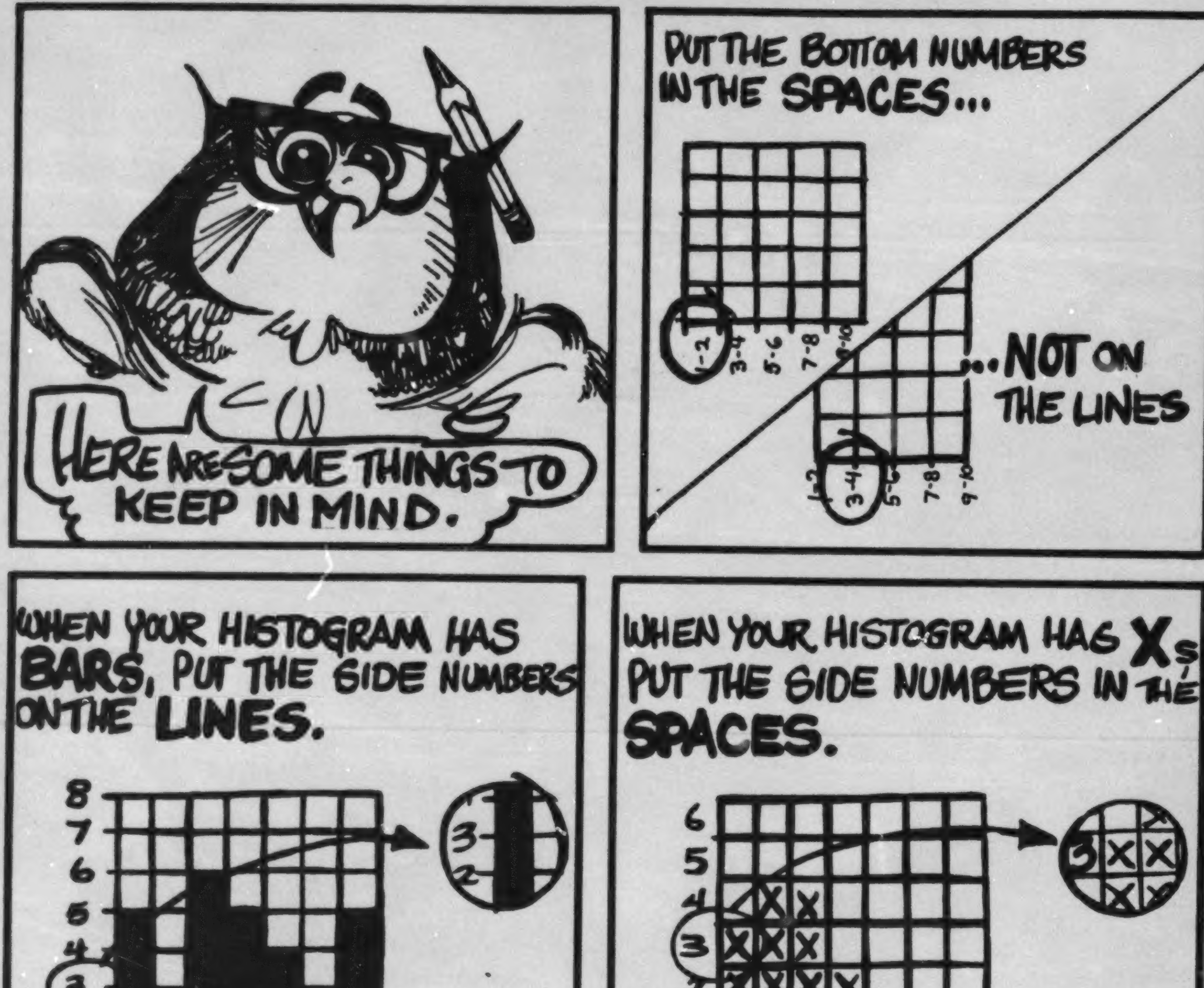

PUT THE MIDDLE OF THE POSTER BETWEEN 123 AND 127 CM HIGH.
127 CM
123 CM
BIKE SALE


EXAMPLE
WE'LL PUT PLANT FOOD ON THESE PEPPER SEEDS...
PLANT FOOD
FAST GRO
BUT NOT THESE.
NO PLANT FOOD
WEEKS LATER
THIS PLANT HAS TWO LEAVES.
NO PLANT FOOD
NUMBER OF PLANTS
NUMBER OF LEAVES
NO PLANT FOOD
THIS PLANT HAS 4 LEAVES.
NO PLANT FOOD
NUMBER OF PLANTS
NUMBER OF LEAVES
NO PLANT FOOD
NUMBER OF PLANTS
1 2 3 4 5 6 7 8 9
1-2 3-4 5-6 7-8 9-10 11-12
NUMBER OF LEAVES
THIS PLANT HAS 4 LEAVES.
NUMBER OF PLANTS
NUMBER OF LEAVES
THIS PLANT HAS 6 LEAVES.
PLANT FOOD
NUMBER OF PLANTS
NUMBER OF LEAVES
PLANT FOOD
PLANT FOOD
NUMBER OF PLANTS
1 2 3 4 5 6 7 8 9
1-2 3-4 5-6 7-8 9-10 11-12
NUMBER OF LEAVES


NO PLANT FOOD
NUMBER OF PLANTS
1 2 3 4 5 6 7 8 9
1-2 3-4 5-6 7-8 9-10 11-12
NUMBER OF LEAVES
PLANT FOOD
NUMBER OF PLANTS
1 2 3 4 5 6 7 8 9
1-2 3-4 5-6 7-8 9-10 11-12
NUMBER OF LEAVES
?
HOW CAN I COMPARE THESE TWO GRAPHS?


THE GRAPHS HAVE THE SAME SHAPE. BUT ONE SHAPE IS MORE TO THE RIGHT.
PLANT FOOD HELPS PEPPER PLANTS GROW MORE LEAVES.
NO PLANT FOOD
NUMBER OF PLANTS
1 2 3 4 5 6 7 8 9
1-2 3-4 5-6 7-8 9-10 11-12
NUMBER OF LEAVES
PLANT FOOD
NUMBER OF PLANTS
1 2 3 4 5 6 7 8 9
1-2 3-4 5-6 7-8 9-10 11-12
NUMBER OF LEAVES


EXAMPLE
ZIP
SCHOOL
WE'RE TAKING A SURVEY OF EVERYONE IN SCHOOL.
HOW MANY MINUTES DOES IT TAKE YOU TO WALK TO SCHOOL?
☐ 3-7
☐ 8-12
☐ 13-17
☐ 18-22
☐ 23-27
☐ 28-32
3-7
8-12
13-17
18-22
23-27
WALKING TIMES SEPT. 29
TIME (MINUTES) NUMBER OF KIDS
3-7 63
8-12 97
13-17 200
18-22 82
23-27 43
27-32 15
?
200
199
198
197
196
195
BUT MY PAPER HAS ONLY 50 SPACES!
LET EACH SPACE STAND FOR 10.
I CAN'T PUT 10 XS IN ONE SPACE!
40
30
20
10
0
3-7
13-17
18-22
MAKE A BAR.
NUMBER OF KIDS
TIME (MINUTES)
WALKING TIMES
NUMBER OF KIDS
TIME (MINUTES)
EVERYTHING FITS!


HERE ARE SOME THINGS TO KEEP IN MIND.
PUT THE BOTTOM NUMBERS IN THE SPACES...
1-2
3-4
5-6
7-8
9-10
...NOT ON THE LINES
1-2
3-4
5-6
7-8
9-10
WHEN YOUR HISTOGRAM HAS BARS, PUT THE SIDE NUMBERS ON THE LINES.
8
7
6
5
4
3
2
1
3
2
WHEN YOUR HISTOGRAM HAS Xs, PUT THE SIDE NUMBERS IN THE SPACES.
6
5
4
3
2
1
3
EACH SPACE IS THE SAME SIZE.
NOT LIKE THIS.

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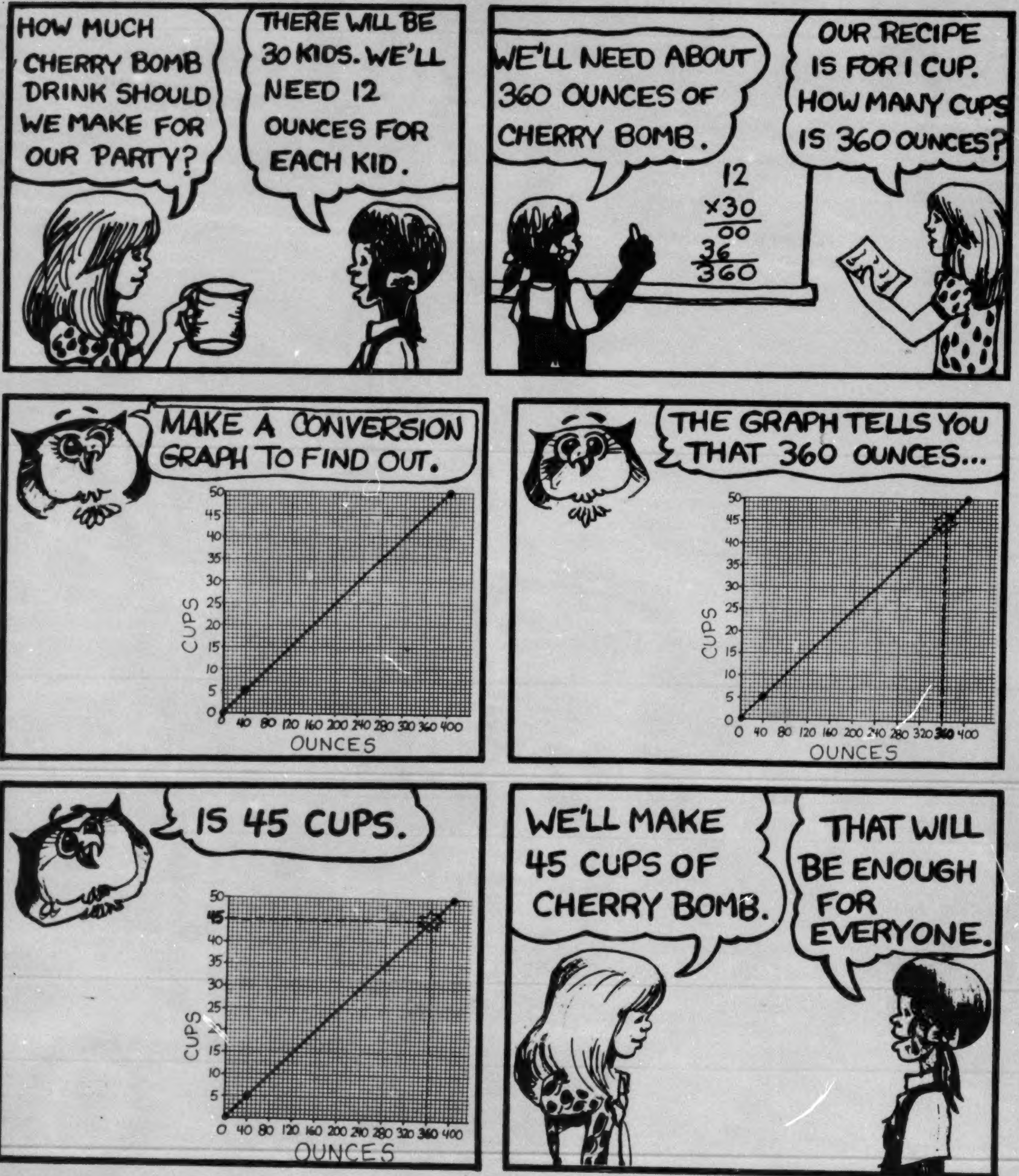
HOW TO

MAKE A CONVERSION GRAPH

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS


HOW MUCH CHERRY BOMB DRINK SHOULD WE MAKE FOR OUR PARTY?
THERE WILL BE 30 KIDS. WE'LL NEED 12 OUNCES FOR EACH KID.
WE'LL NEED ABOUT 360 OUNCES OF CHERRY BOMB.
12 ×30 00 36 360
OUR RECIPE IS FOR 1 CUP. HOW MANY CUPS IS 360 OUNCES?
MAKE A CONVERSION GRAPH TO FIND OUT.
CUPS
OUNCES
0 5 10 15 20 25 30 35 40 45 50
0 40 80 120 160 200 240 280 320 360 400
THE GRAPH TELLS YOU THAT 360 OUNCES...
IS 45 CUPS.
WE'LL MAKE 45 CUPS OF CHERRY BOMB.
THAT WILL BE ENOUGH FOR EVERYONE.

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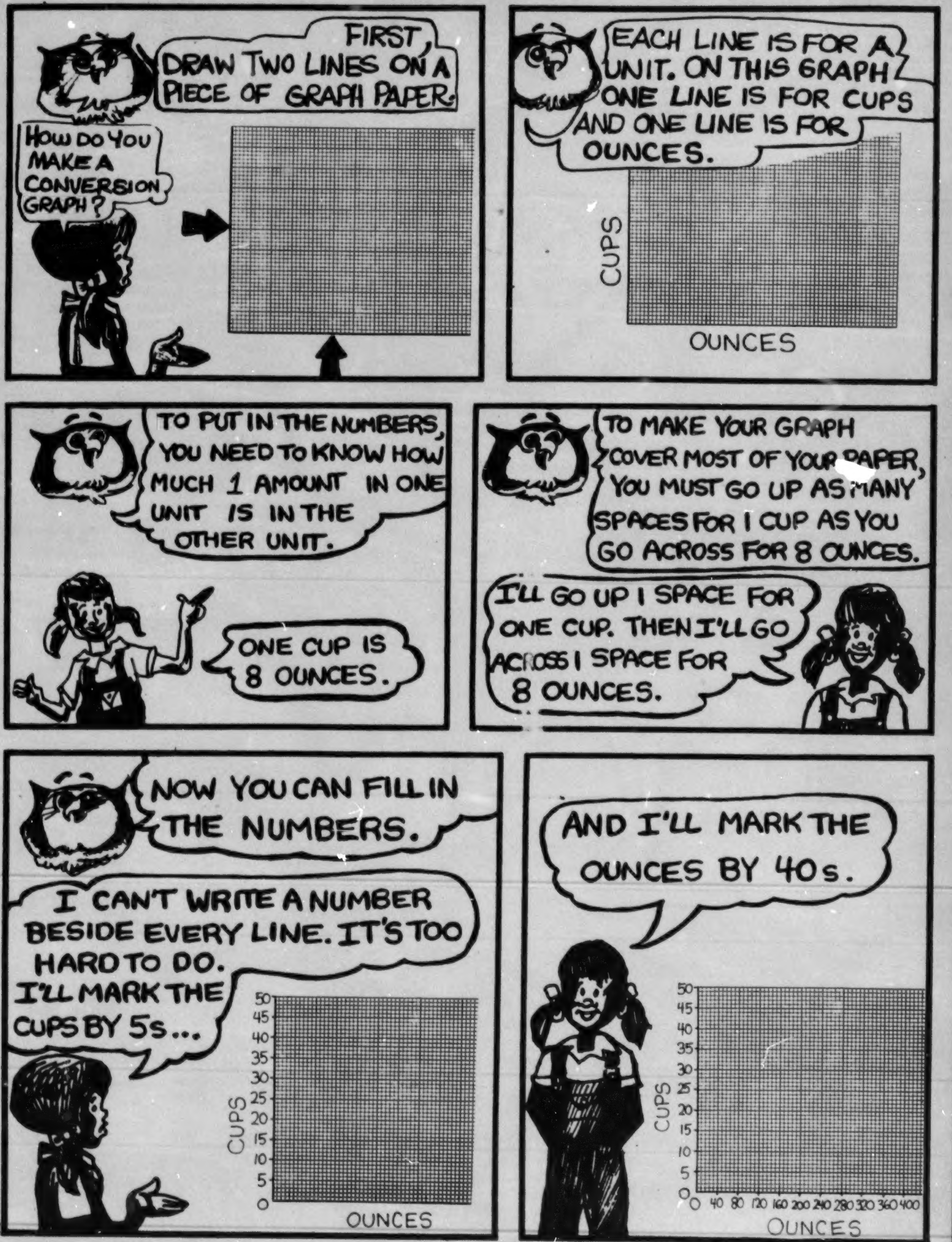
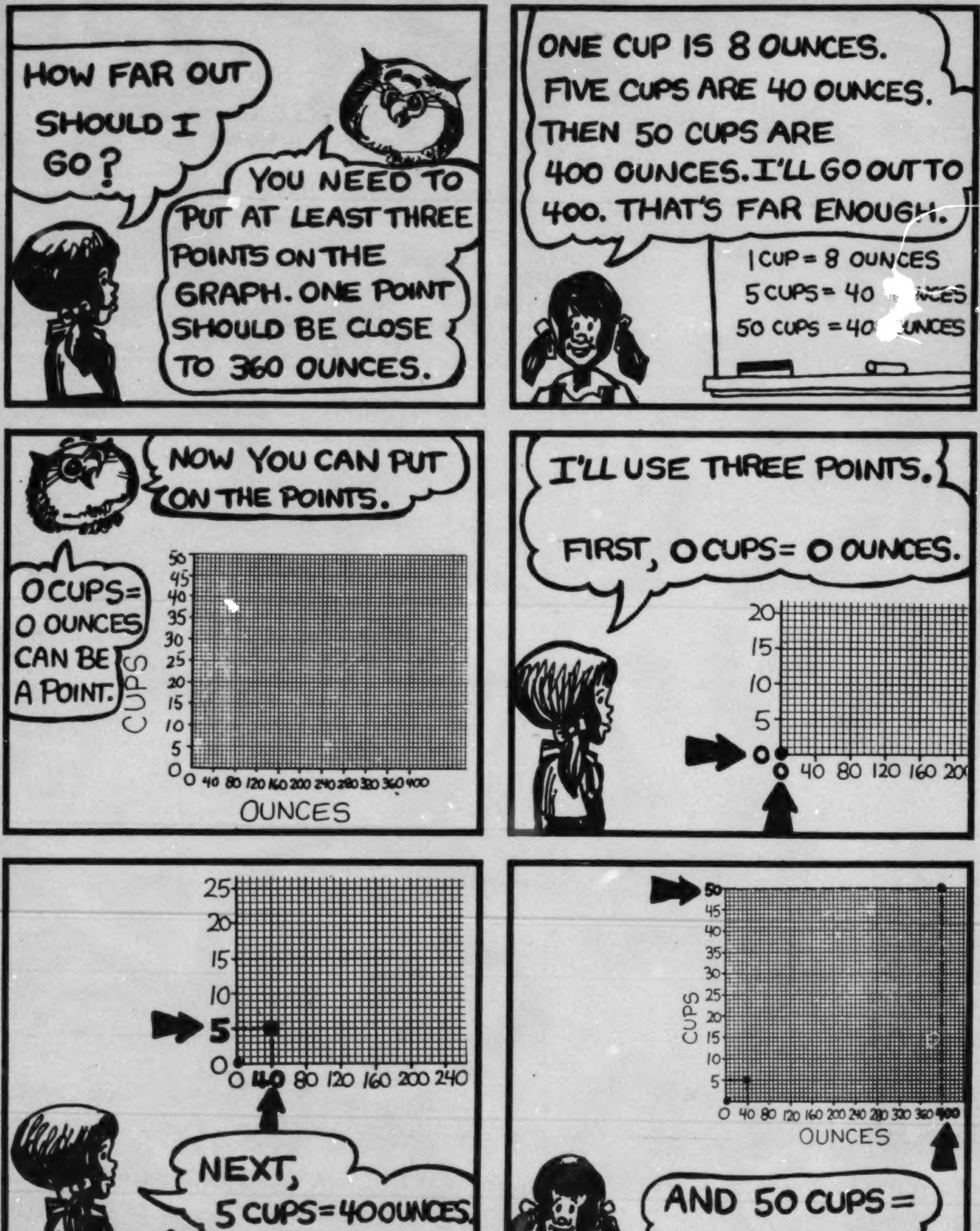
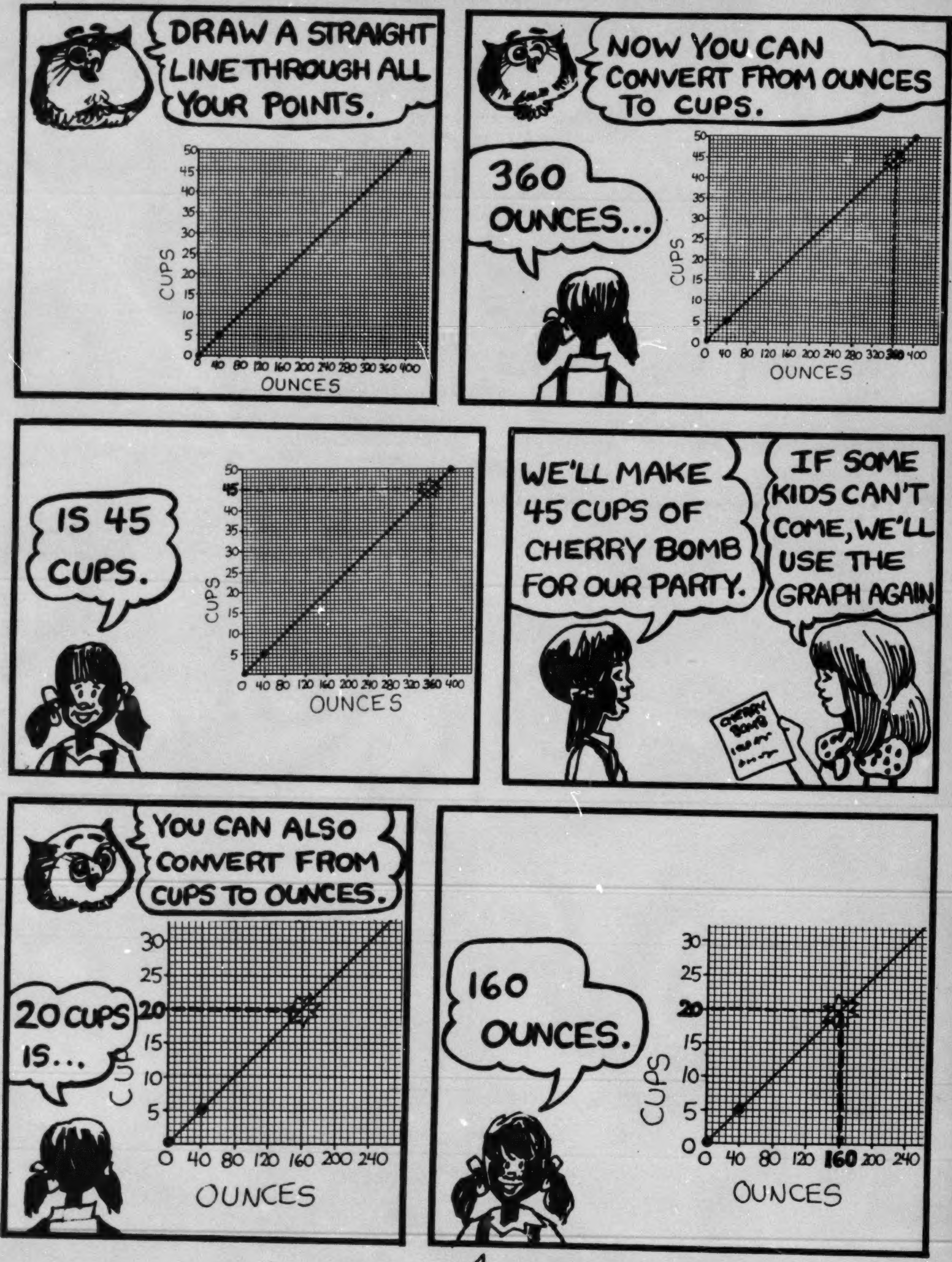
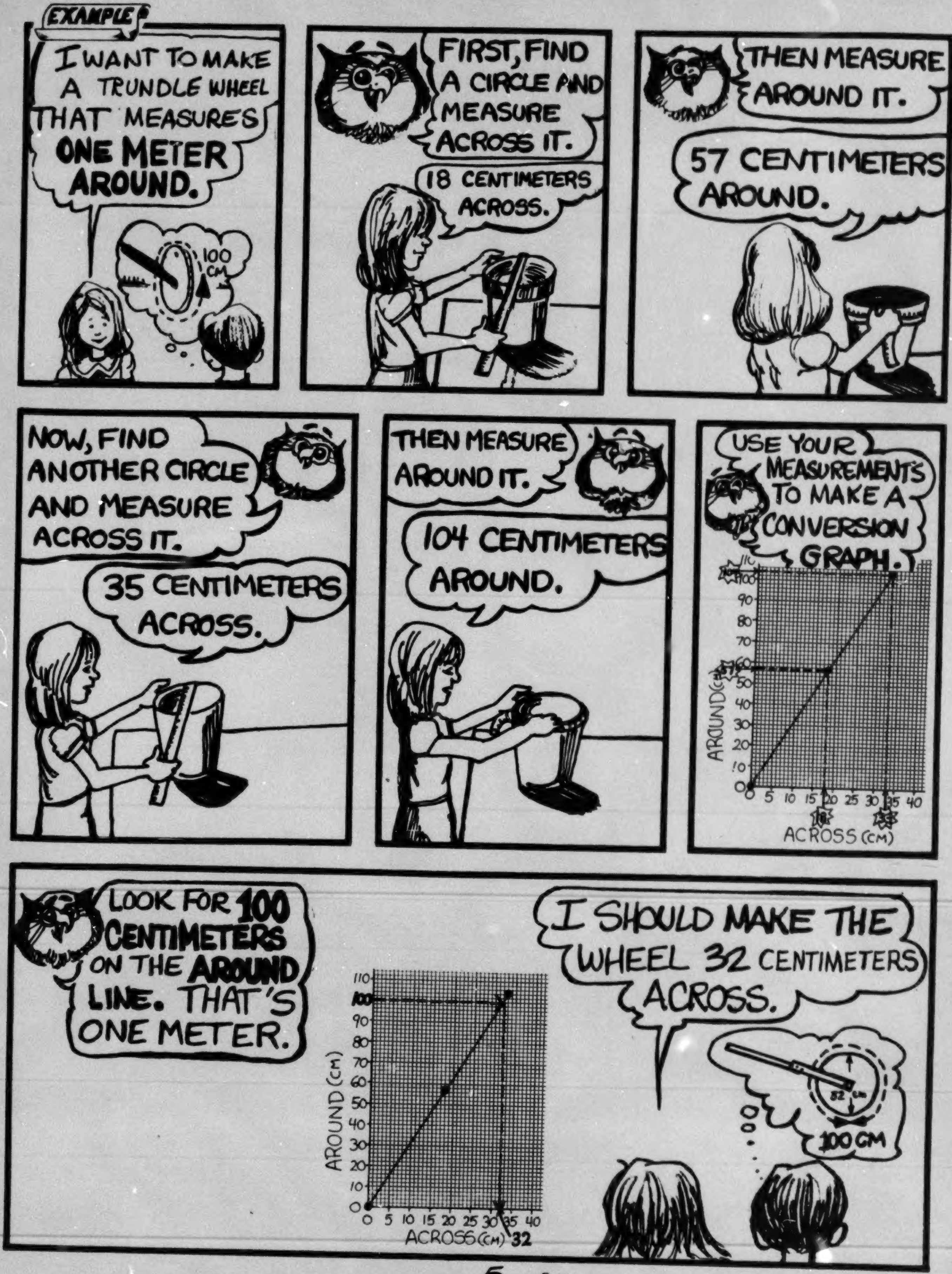
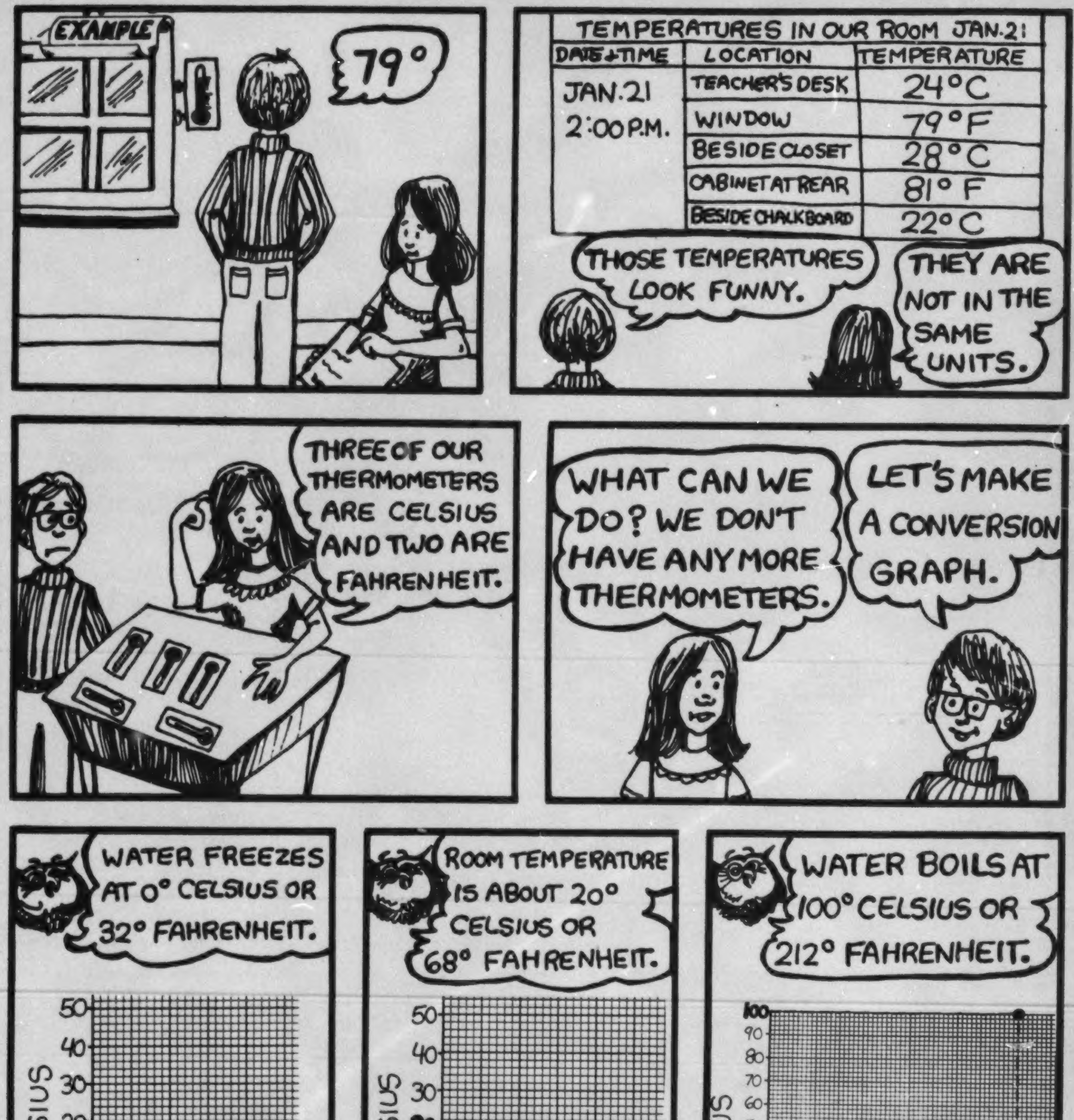

FIRST, DRAW TWO LINES ON A PIECE OF GRAPH PAPER.
HOW DO YOU MAKE A CONVERSION GRAPH?
EACH LINE IS FOR A UNIT. ON THIS GRAPH ONE LINE IS FOR CUPS AND ONE LINE IS FOR OUNCES.
CUPS
OUNCES
TO PUT IN THE NUMBERS, YOU NEED TO KNOW HOW MUCH 1 AMOUNT IN ONE UNIT IS IN THE OTHER UNIT.
ONE CUP IS 8 OUNCES.
TO MAKE YOUR GRAPH COVER MOST OF YOUR PAPER, YOU MUST GO UP AS MANY SPACES FOR 1 CUP AS YOU GO ACROSS FOR 8 OUNCES.
I'LL GO UP 1 SPACE FOR ONE CUP. THEN I'LL GO ACROSS 1 SPACE FOR 8 OUNCES.
NOW YOU CAN FILL IN THE NUMBERS.
I CAN'T WRITE A NUMBER BESIDE EVERY LINE. IT'S TOO HARD TO DO. I'LL MARK THE CUPS BY 5s...
0 5 10 15 20 25 30 35 40 45 50
CUPS
OUNCES
AND I'LL MARK THE OUNCES BY 40s.
0 5 10 15 20 25 30 35 40 45 50
CUPS
0 40 80 120 160 200 240 280 320 360 400
OUNCES


HOW FAR OUT SHOULD I GO?
YOU NEED TO PUT AT LEAST THREE POINTS ON THE GRAPH. ONE POINT SHOULD BE CLOSE TO 360 OUNCES.
ONE CUP IS 8 OUNCES. FIVE CUPS ARE 40 OUNCES. THEN 50 CUPS ARE 400 OUNCES. I'LL GO OUT TO 400. THAT'S FAR ENOUGH.
1 CUP = 8 OUNCES
5 CUPS = 40 OUNCES
50 CUPS = 400 OUNCES
NOW YOU CAN PUT ON THE POINTS.
0 CUPS = 0 OUNCES CAN BE A POINT.
CUPS
0 5 10 15 20 25 30 35 40 45 50
0 40 80 120 160 200 240 280 320 360 400
OUNCES
I'LL USE THREE POINTS.
FIRST, 0 CUPS = 0 OUNCES.
0 5 10 15 20
0 40 80 120 160 200
0 5 10 15 20 25
0 40 80 120 160 200 240
NEXT, 5 CUPS = 40 OUNCES.
CUPS
0 5 10 15 20 25 30 35 40 45 50
0 40 80 120 160 200 240 280 320 360 400
OUNCES
AND 50 CUPS = 400 OUNCES.

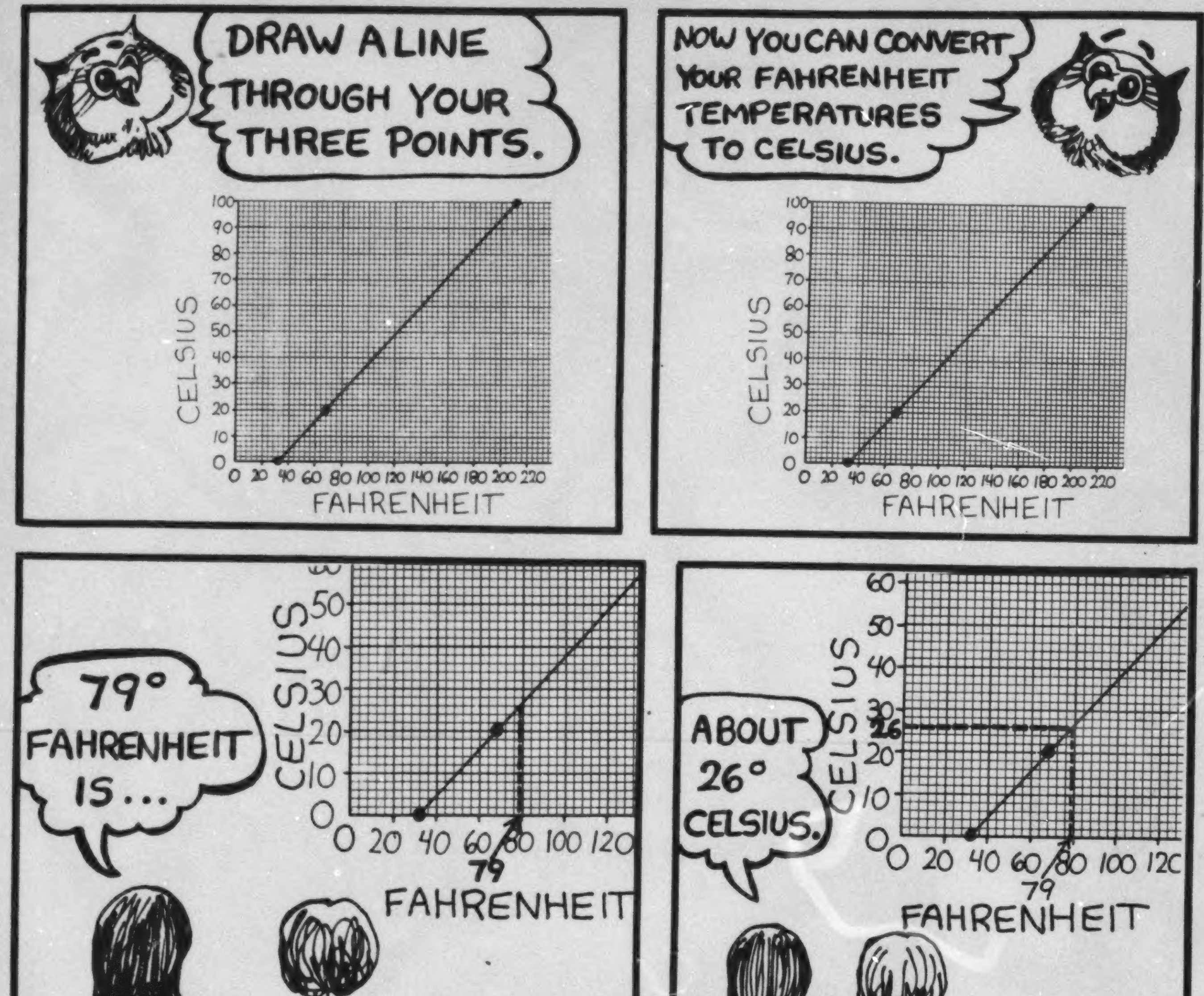

DRAW A STRAIGHT LINE THROUGH ALL YOUR POINTS.
CUPS
OUNCES
0 5 10 15 20 25 30 35 40 45 50
0 40 80 120 160 200 240 280 320 360 400
NOW YOU CAN CONVERT FROM OUNCES TO CUPS.
360 OUNCES...
IS 45 CUPS.
WE'LL MAKE 45 CUPS OF CHERRY BOMB FOR OUR PARTY.
IF SOME KIDS CAN'T COME, WE'LL USE THE GRAPH AGAIN.
CHERRY BOMB
YOU CAN ALSO CONVERT FROM CUPS TO OUNCES.
20 CUPS IS...
160 OUNCES.
0 5 10 15 20 25 30
0 40 80 120 160 200 240

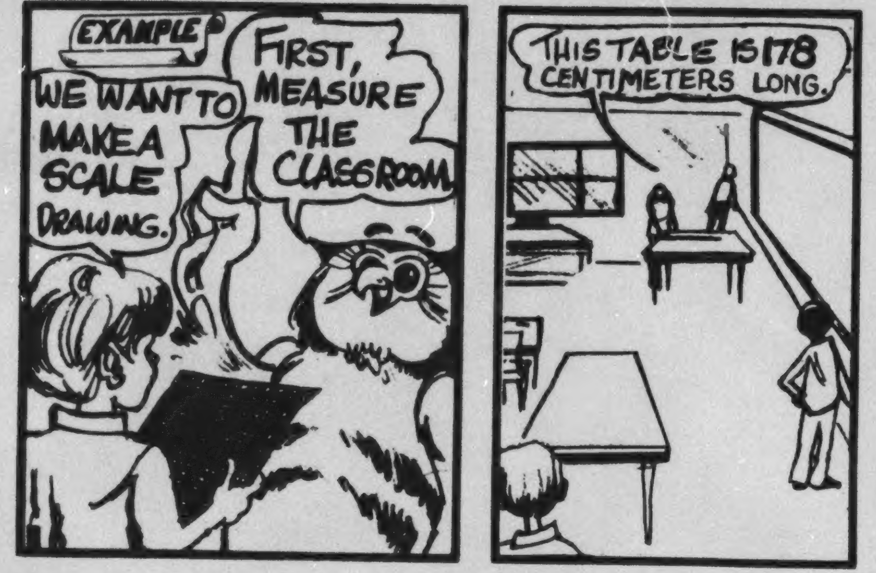

EXAMPLE
I WANT TO MAKE A TRUNDLE WHEEL THAT MEASURES ONE METER AROUND.
100 CM
FIRST, FIND A CIRCLE AND MEASURE ACROSS IT.
18 CENTIMETERS ACROSS.
THEN MEASURE AROUND IT.
57 CENTIMETERS AROUND.
NOW, FIND ANOTHER CIRCLE AND MEASURE ACROSS IT.
35 CENTIMETERS ACROSS.
THEN MEASURE AROUND IT.
104 CENTIMETERS AROUND.
USE YOUR MEASUREMENTS TO MAKE A CONVERSION GRAPH.
AROUND (CM)
0 10 20 30 40 50 57 60 70 80 90 100 104 110
ACROSS (CM)
0 5 10 15 18 20 25 30 35 40
LOOK FOR 100 CENTIMETERS ON THE AROUND LINE. THAT'S ONE METER.
AROUND (CM)
0 10 20 30 40 50 60 70 80 90 100 110
ACROSS (CM)
0 5 10 15 20 25 30 35 40 32
I SHOULD MAKE THE WHEEL 32 CENTIMETERS ACROSS.
32 CM
100 CM

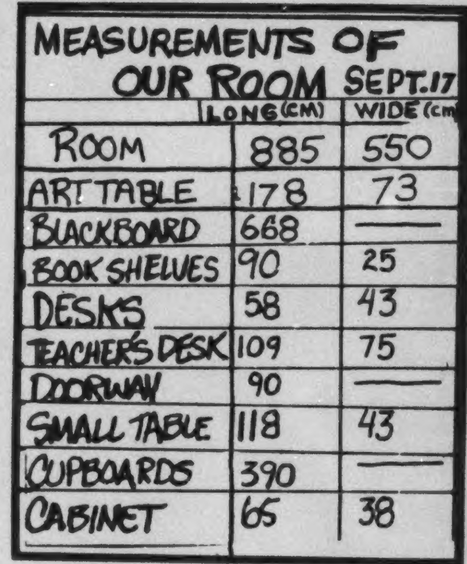

EXAMPLE
79°
TEMPERATURES IN OUR ROOM JAN. 21

DATE + TIME	LOCATION	TEMPERATURE
JAN. 21 2:00 P.M.	TEACHER'S DESK	24°C
	WINDOW	79°F
	BESIDE CLOSET	28°C
	CABINET AT REAR	81°F
	BESIDE CHALKBOARD	22°C

THOSE TEMPERATURES LOOK FUNNY.
THEY ARE NOT IN THE SAME UNITS.
THREE OF OUR THERMOMETERS ARE CELSIUS AND TWO ARE FAHRENHEIT.
WHAT CAN WE DO? WE DON'T HAVE ANY MORE THERMOMETERS.
LET'S MAKE A CONVERSION GRAPH.
WATER FREEZES AT 0° CELSIUS OR 32° FAHRENHEIT.
CELSIUS
50
40
30
20
10
0
0 20 40 60 80 100
32
FAHRENHEIT
0°C=32°F
ROOM TEMPERATURE IS ABOUT 20° CELSIUS OR 68° FAHRENHEIT.
CELSIUS
50
40
30
20
10
0
0 20 40 60 80 100
68
FAHRENHEIT
20°C= 68°F
WATER BOILS AT 100° CELSIUS OR 212° FAHRENHEIT.
CELSIUS
100
90
80
70
60
50
40
30
20
10
0
0 20 40 60 80 100 120 140 160 180 200 220
212
FAHRENHEIT
100°C= 212°F

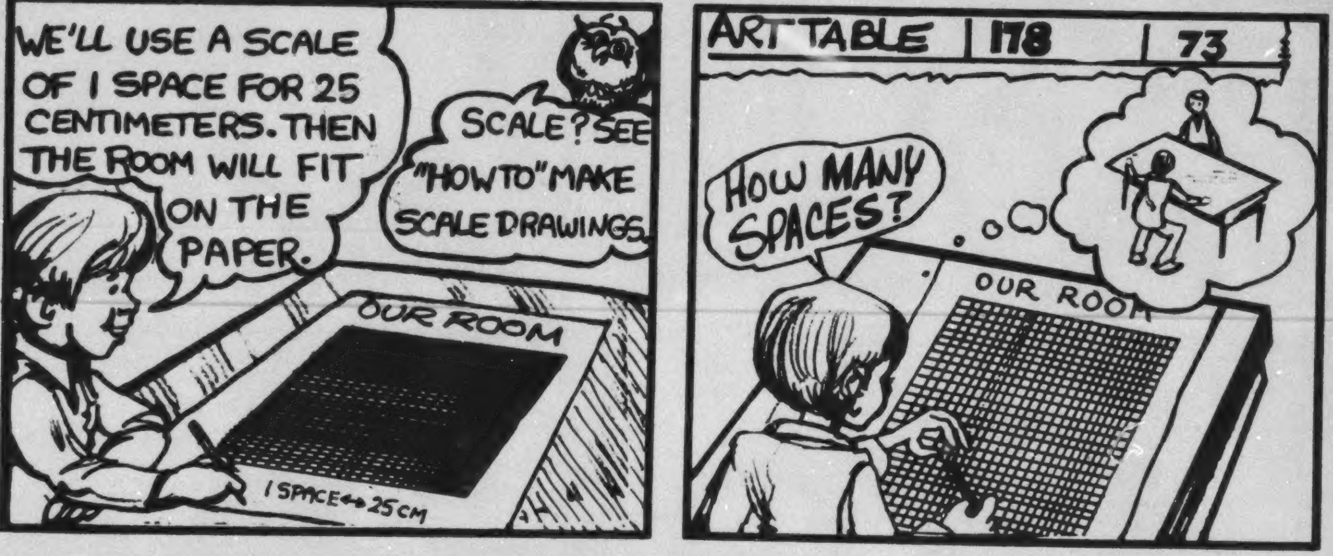

DRAW A LINE THROUGH YOUR THREE POINTS.
CELSIUS
0 10 20 30 40 50 60 70 80 90 100
FAHRENHEIT
0 20 40 60 80 100 120 140 160 180 200 220
NOW YOU CAN CONVERT YOUR FAHRENHEIT TEMPERATURES TO CELSIUS.
CELSIUS
0 10 20 30 40 50 60 70 80 90 100
FAHRENHEIT
0 20 40 60 80 100 120 140 160 180 200 220
79° FAHRENHEIT IS...
CELSIUS
0 10 20 30 40 50
FAHRENHEIT
0 20 40 60 80 100 120
79
ABOUT 26° CELSIUS.
CELSIUS
0 10 20 26 30 40 50 60
FAHRENHEIT
0 20 40 60 80 100 120
79
AND 81° F IS ABOUT 27°C.
0 10 20 27 30 40 50 60 70
0 20 40 60 80 100 120
81
NOW WE CAN USE ALL 5 THERMOMETERS.
WE CAN CONVERT FROM FAHRENHEIT TO CELSIUS.

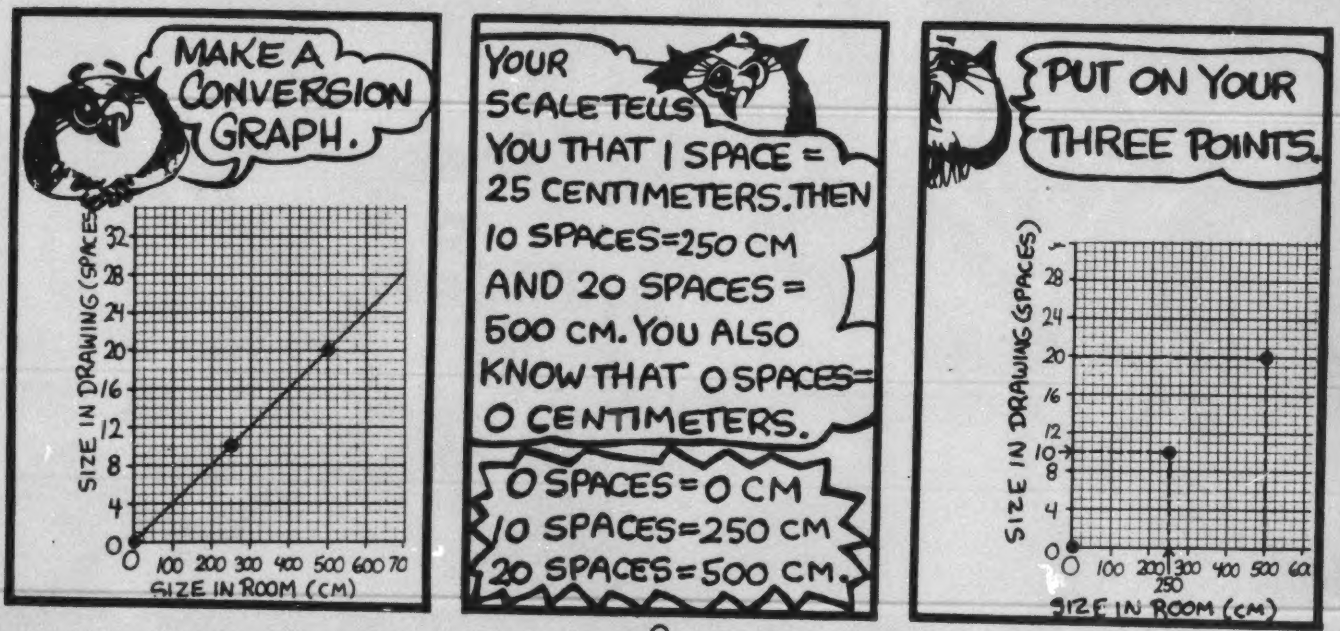

EXAMPLE
WE WANT TO MAKE A SCALE DRAWING.
FIRST, MEASURE THE CLASSROOM.
THIS TABLE IS 178 CENTIMETERS LONG.

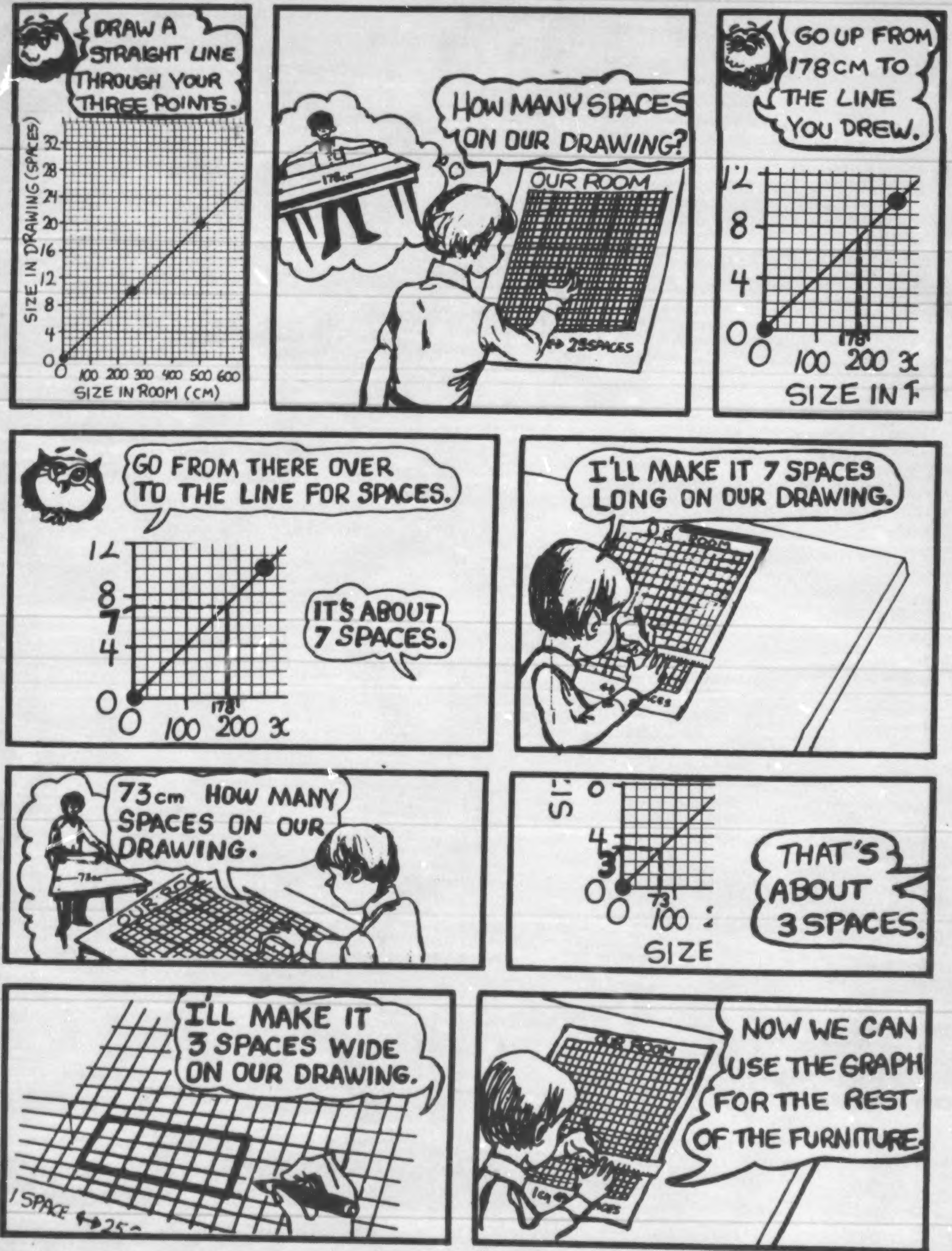


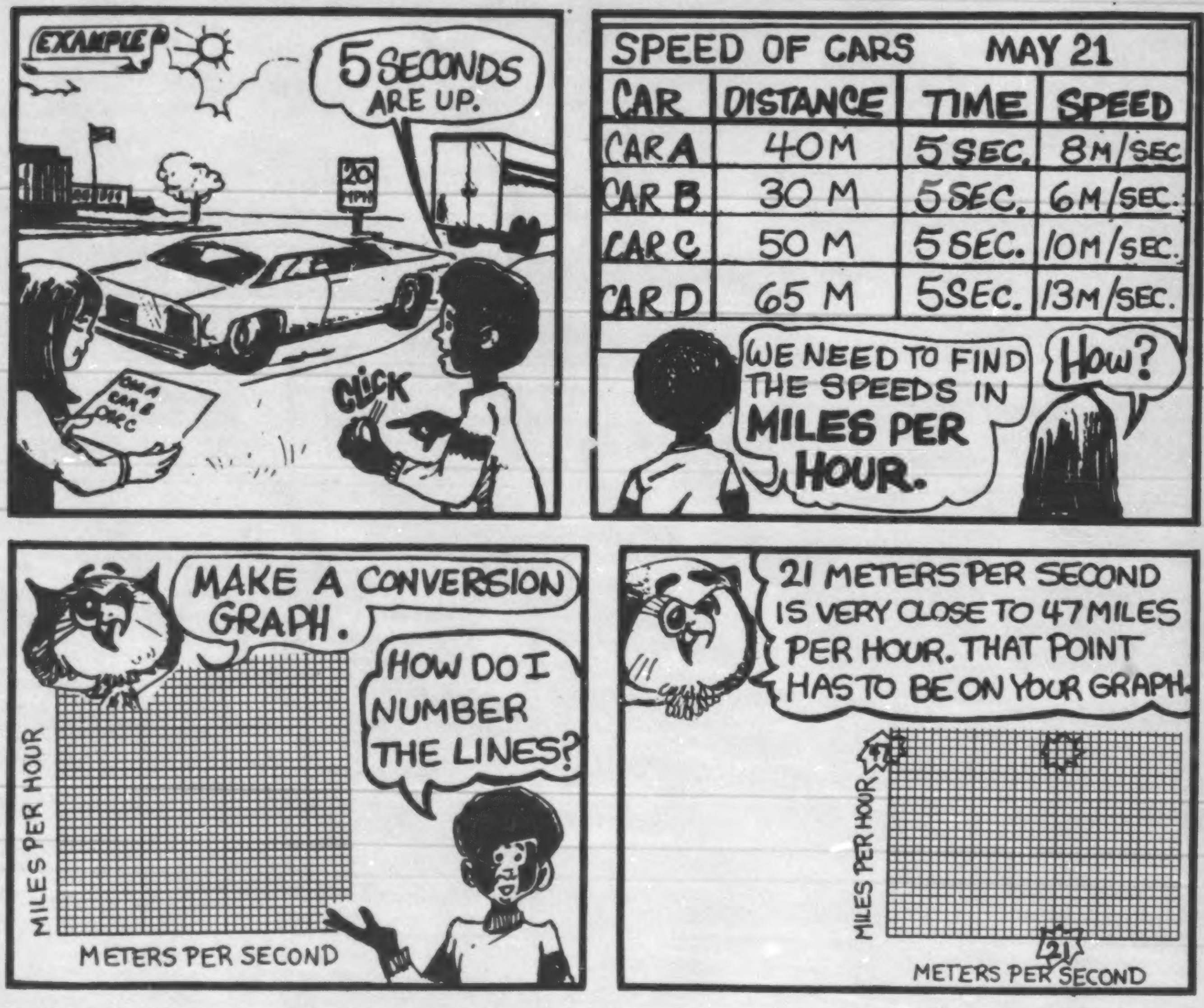
MEASUREMENTS OF OUR ROOM SEPT. 17

	LONG (CM)	WIDE (cm
ROOM	885	550
ART TABLE	178	73
BLACKBOARD	668	—
BOOK SHELVES	90	25
DESKS	58	43
TEACHER'S DESK	109	75
DOORWAY	90	—
SMALL TABLE	118	43
CUPBOARDS	390	—
CABINET	65	38


WE'LL USE A SCALE OF 1 SPACE FOR 25 CENTIMETERS. THEN THE ROOM WILL FIT ON THE PAPER.
SCALE? SEE "HOW TO" MAKE SCALE DRAWINGS.
OUR ROOM
1 SPACE ↔ 25 CM
ART TABLE | 178 | 73
HOW MANY SPACES?
OUR ROOM


MAKE A CONVERSION GRAPH.
SIZE IN DRAWING (SPACES)
0
4
8
12
16
20
24
28
32
0
100
200
300
400
500
600
70
SIZE IN ROOM (CM)
YOUR SCALE TELLS YOU THAT 1 SPACE = 25 CENTIMETERS. THEN 10 SPACES = 250 CM AND 20 SPACES = 500 CM. YOU ALSO KNOW THAT 0 SPACES = 0 CENTIMETERS.
0 SPACES = 0 CM
10 SPACES = 250 CM
20 SPACES = 500 CM.
PUT ON YOUR THREE POINTS.
SIZE IN DRAWING (SPACES)
0
4
8
10
12
16
20
24
28
0
100
200
250
300
400
500
60
SIZE IN ROOM (CM)


DRAW A STRAIGHT LINE THROUGH YOUR THREE POINTS.
SIZE IN DRAWING (SPACES)
32 28 24 20 16 12 8 4 0
0 100 200 300 400 500 600
SIZE IN ROOM (CM)
HOW MANY SPACES ON OUR DRAWING?
178cm
OUR ROOM
28 SPACES
GO UP FROM 178 CM TO THE LINE YOU DREW.
12 8 4 0
0 100 178 200 3
SIZE IN
GO FROM THERE OVER TO THE LINE FOR SPACES.
12 8 7 4 0
0 100 178 200 3
IT'S ABOUT 7 SPACES.
I'LL MAKE IT 7 SPACES LONG ON OUR DRAWING.
73cm HOW MANY SPACES ON OUR DRAWING.
73cm
OUR ROOM
4 3 0
0 73 100
SIZE
THAT'S ABOUT 3 SPACES.
I'LL MAKE IT 3 SPACES WIDE ON OUR DRAWING.
1 SPACE ↔ 25
NOW WE CAN USE THE GRAPH FOR THE REST OF THE FURNITURE.
OUR ROOM

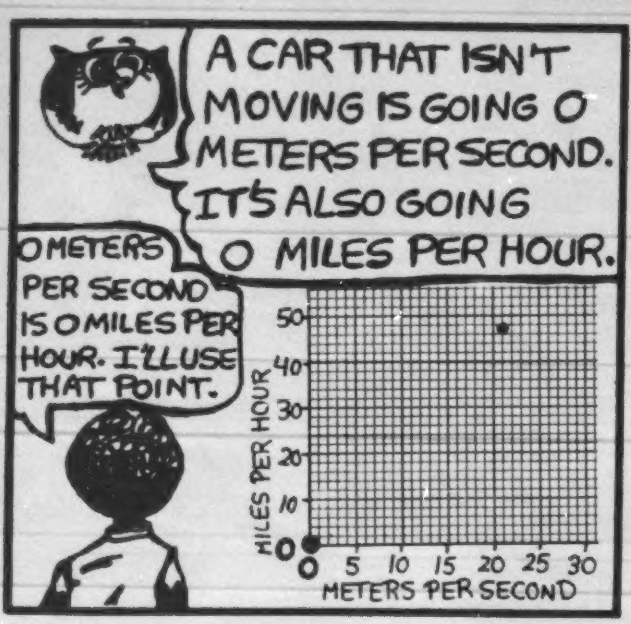


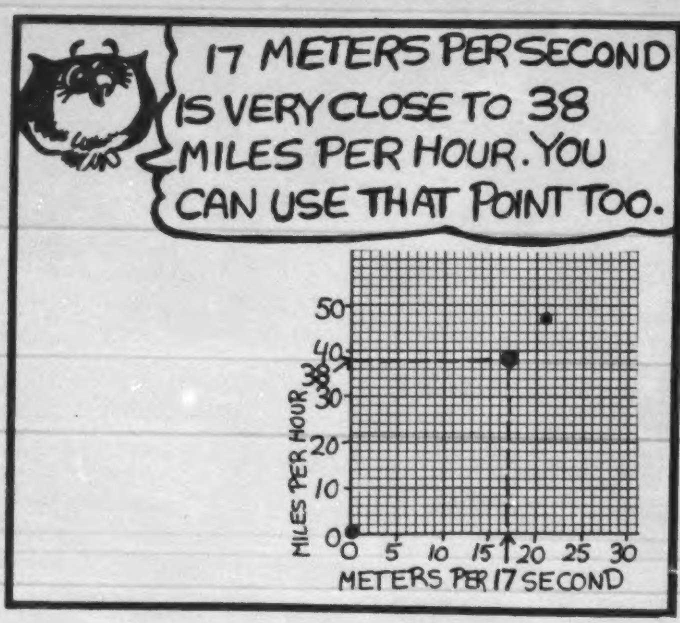
EXAMPLE
5 SECONDS ARE UP.
20 MPH
CLICK

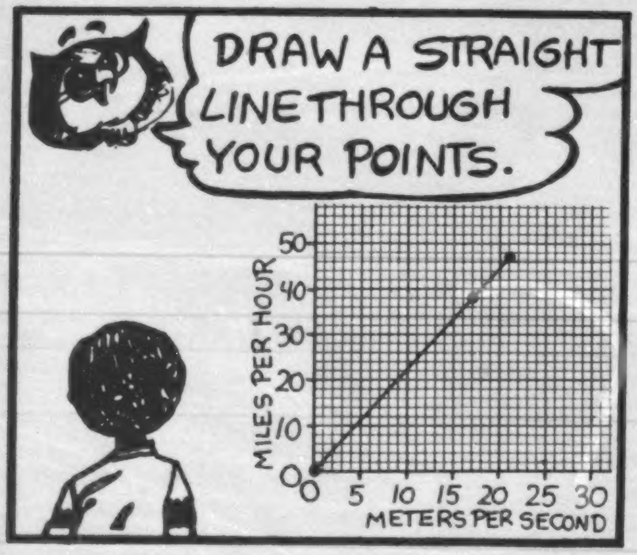
SPEED OF CARS MAY 21

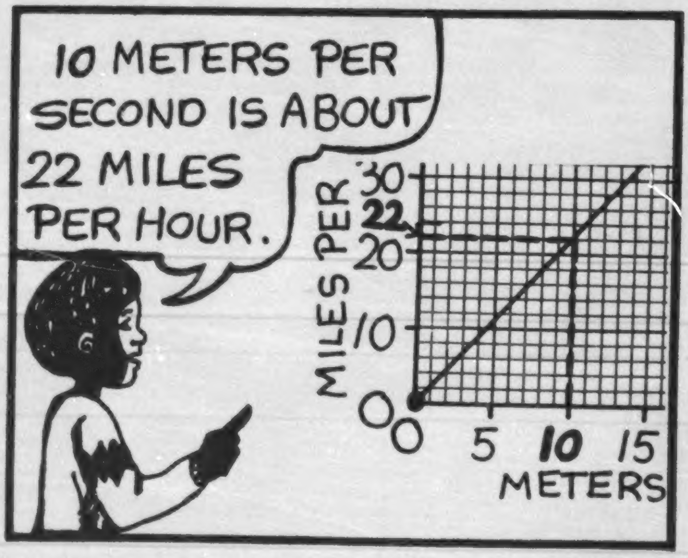
CAR	DISTANCE	TIME	SPEED
CAR A	40 M	5 SEC.	8 M/SEC
CAR B	30 M	5 SEC.	6 M/SEC.
CAR C	50 M	5 SEC.	10 M/SEC.
CAR D	65 M	5 SEC.	13 M/SEC.

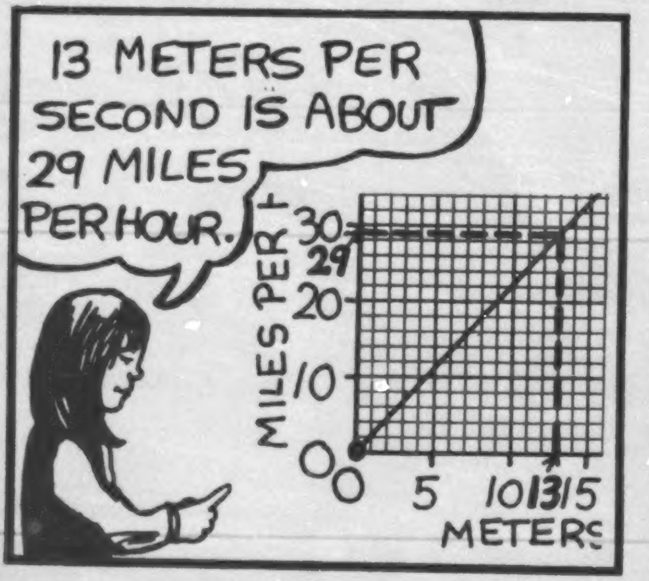
WE NEED TO FIND THE SPEEDS IN MILES PER HOUR.
How?
MAKE A CONVERSION GRAPH.
HOW DO I NUMBER THE LINES?
MILES PER HOUR
METERS PER SECOND
21 METERS PER SECOND IS VERY CLOSE TO 47 MILES PER HOUR. THAT POINT HAS TO BE ON YOUR GRAPH.
47
21
MILES PER HOUR
METERS PER SECOND
NUMBER YOUR LINES SO THE GRAPH COVERS MOST OF THE PAPER. LET EACH SPACE ACROSS STAND FOR 1 METER PER SECOND.
LET EACH SPACE UP STAND FOR 2 MILES PER HOUR.
0 10 20 30 40 50
MILES PER HOUR
0 5 10 15 20 25 30
METERS PER SECOND
HOW DO I PUT ON THE POINTS?
FIRST, PUT ON THE POINT FOR 21 METERS PER SECOND AND 47 MILES PER HOUR.
0 10 20 30 40 47 50
MILES PER HOUR
0 5 10 15 20 21 25 30
METERS PER SECOND

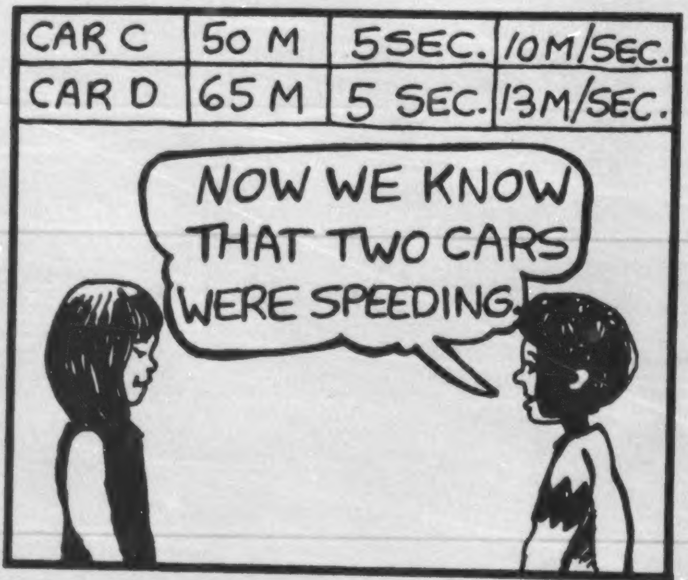

A CAR THAT ISN'T MOVING IS GOING 0 METERS PER SECOND. IT'S ALSO GOING 0 MILES PER HOUR.
0 METERS PER SECOND IS 0 MILES PER HOUR. I'LL USE THAT POINT.
MILES PER HOUR
0
10
20
30
40
50
0
5
10
15
20
25
30
METERS PER SECOND

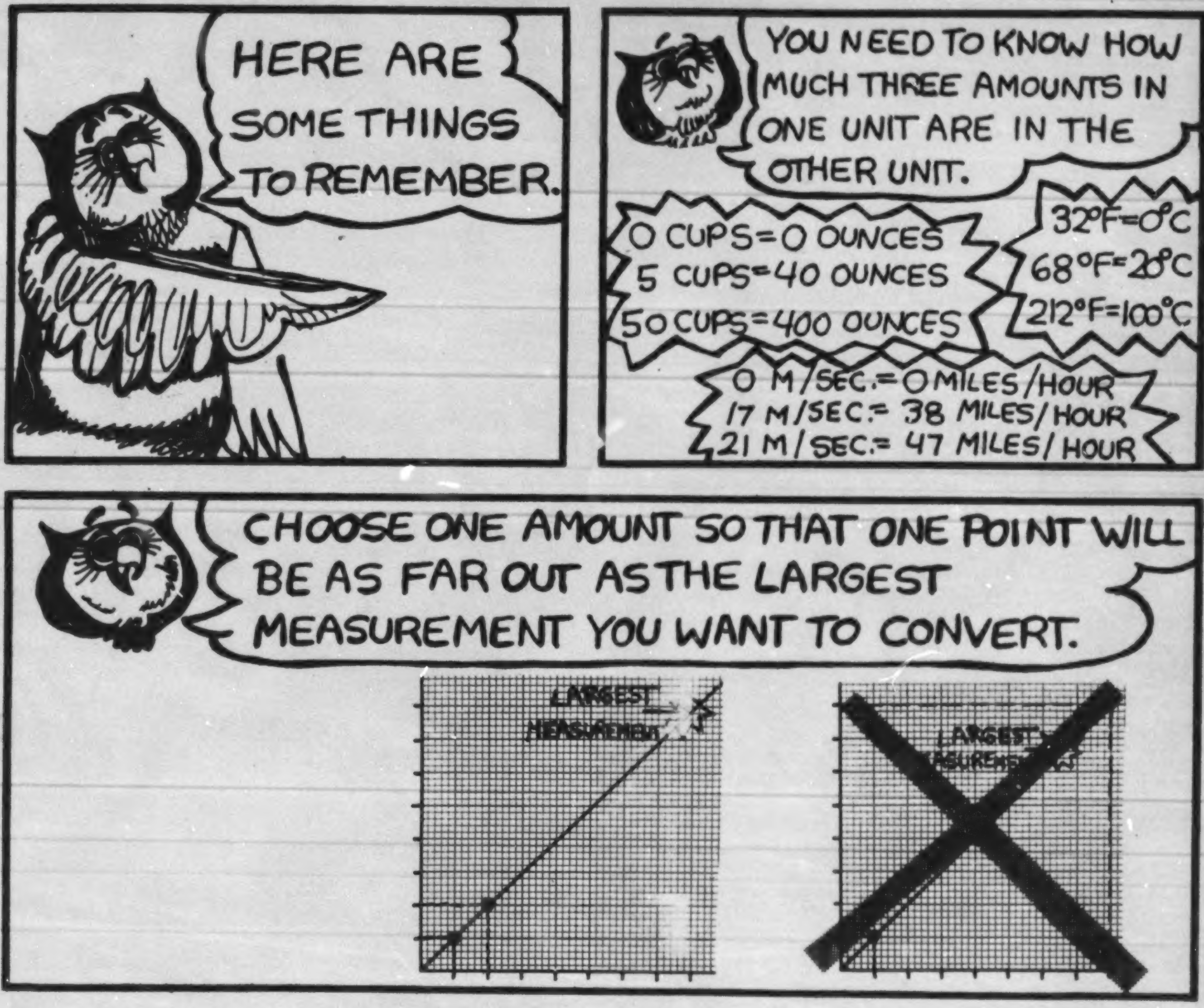

17 METERS PER SECOND IS VERY CLOSE TO 38 MILES PER HOUR. YOU CAN USE THAT POINT TOO.
MILES PER HOUR
0
10
20
30
38
40
50
0
5
10
15
17
20
25
30
METERS PER SECOND


DRAW A STRAIGHT LINE THROUGH YOUR POINTS.
MILES PER HOUR
0
10
20
30
40
50
0
5
10
15
20
25
30
METERS PER SECOND


10 METERS PER SECOND IS ABOUT 22 MILES PER HOUR.
MILES PER
0
10
20
22
30
0
5
10
15
METERS


13 METERS PER SECOND IS ABOUT 29 MILES PER HOUR.
MILES PER
0
10
20
29
30
0
5
10
13
15
METERS


CAR C | 50 M | 5 SEC. | 10 M/SEC.
CAR D | 65 M | 5 SEC. | 13 M/SEC.
NOW WE KNOW THAT TWO CARS WERE SPEEDING.


HERE ARE SOME THINGS TO REMEMBER.
YOU NEED TO KNOW HOW MUCH THREE AMOUNTS IN ONE UNIT ARE IN THE OTHER UNIT.
0 CUPS = 0 OUNCES
5 CUPS = 40 OUNCES
50 CUPS = 400 OUNCES
32°F = 0°C
68°F = 20°C
212°F = 100°C
0 M/SEC. = 0 MILES/HOUR
17 M/SEC. = 38 MILES/HOUR
21 M/SEC. = 47 MILES/HOUR
CHOOSE ONE AMOUNT SO THAT ONE POINT WILL BE AS FAR OUT AS THE LARGEST MEASUREMENT YOU WANT TO CONVERT.
LARGEST MEASUREMENT
LARGEST MEASUREMENT
NUMBER YOUR LINES SO THE GRAPH WILL USE MOST OF THE PAPER.

edc

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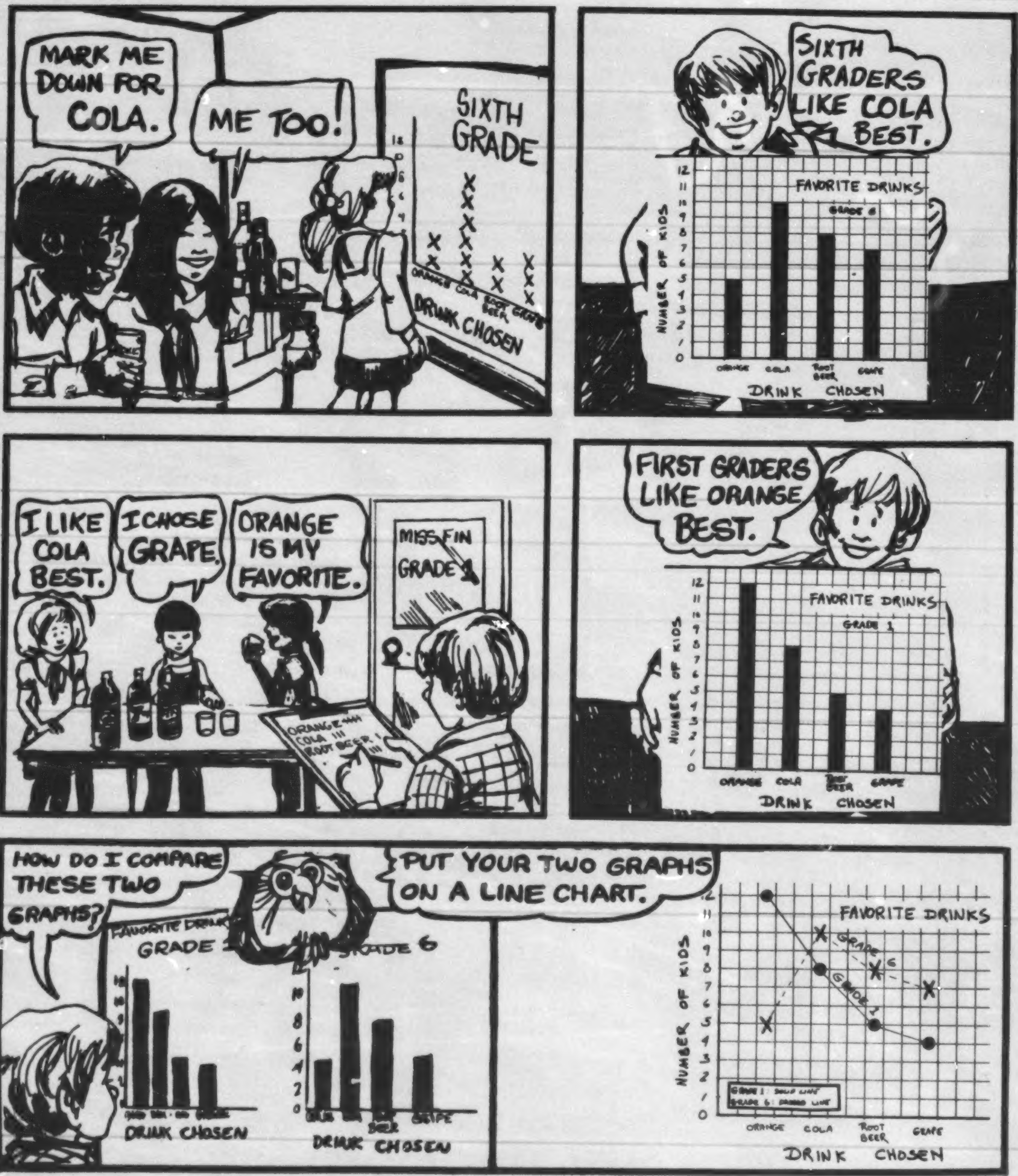
HOW TO
MAKE A LINE CHART

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS


MARK ME DOWN FOR COLA.
ME TOO!
SIXTH GRADE
12 10 8 6 4 2
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
SIXTH GRADERS LIKE COLA BEST.
FAVORITE DRINKS
GRADE 6
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
I LIKE COLA BEST.
I CHOSE GRAPE.
ORANGE IS MY FAVORITE.
MISS FIN GRADE 1
ORANGE 卌
COLA III
ROOT BEER I
III
FIRST GRADERS LIKE ORANGE BEST.
FAVORITE DRINKS
GRADE 1
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
HOW DO I COMPARE THESE TWO GRAPHS?
PUT YOUR TWO GRAPHS ON A LINE CHART.
FAVORITE DRINKS
GRADE 1
GRADE 6
DRINK CHOSEN
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
FAVORITE DRINKS
GRADE 6
GRADE 1
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
GRADE 1: SOLID LINE
GRADE 6: DASHED LINE
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN

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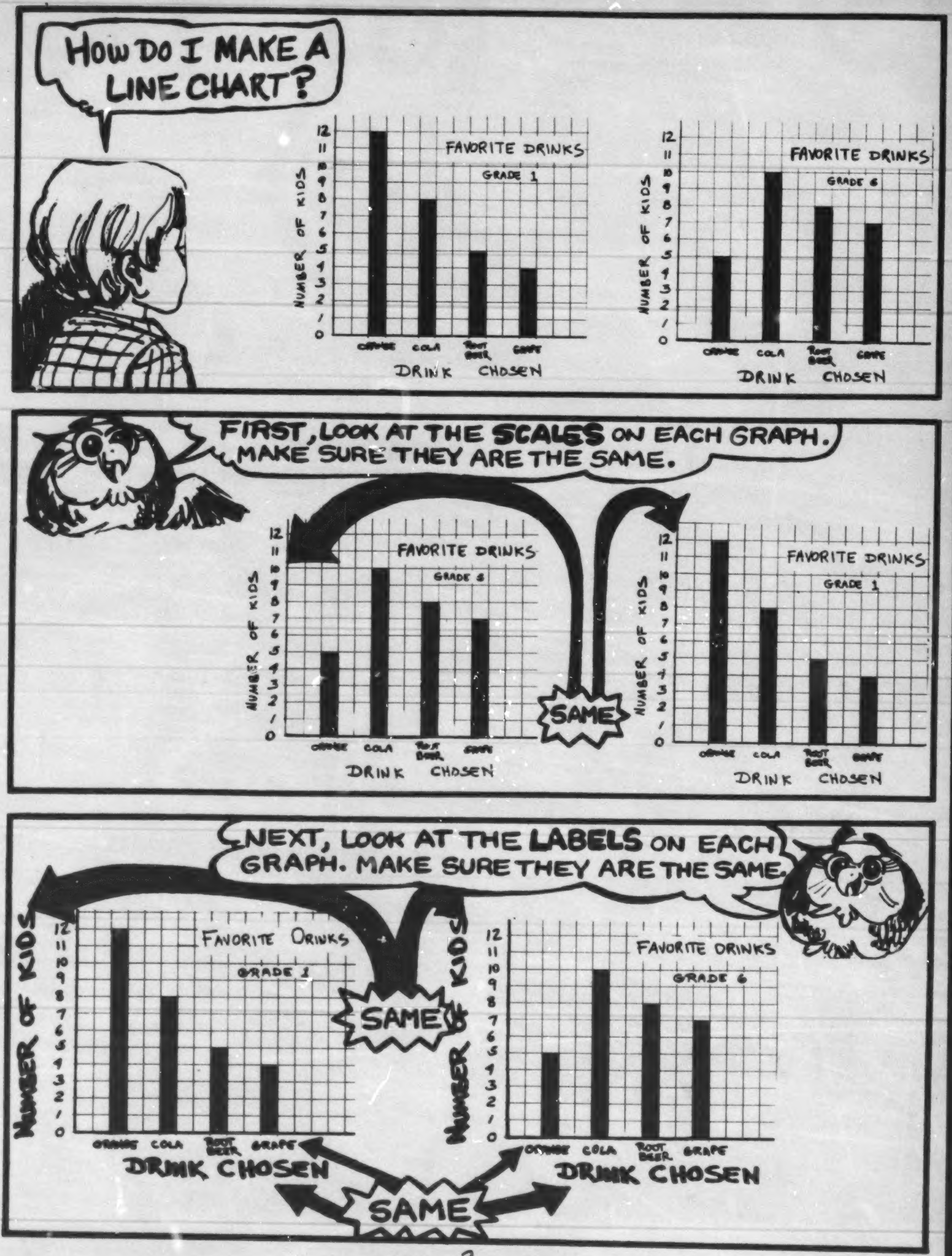
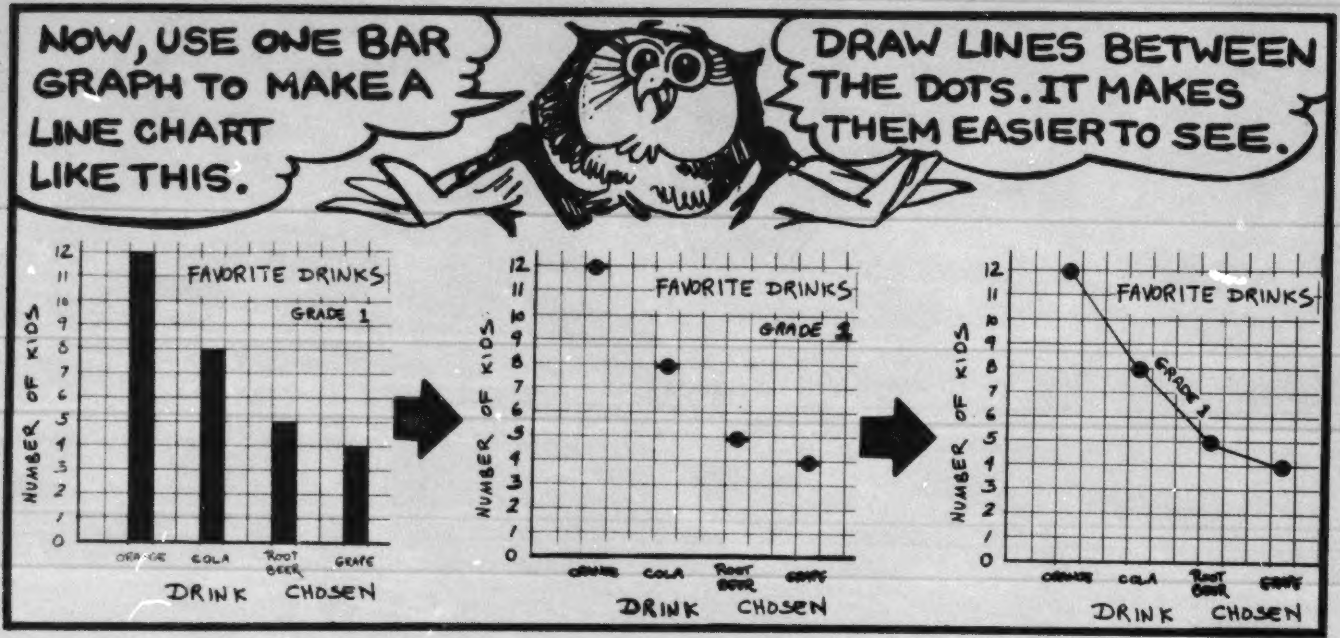
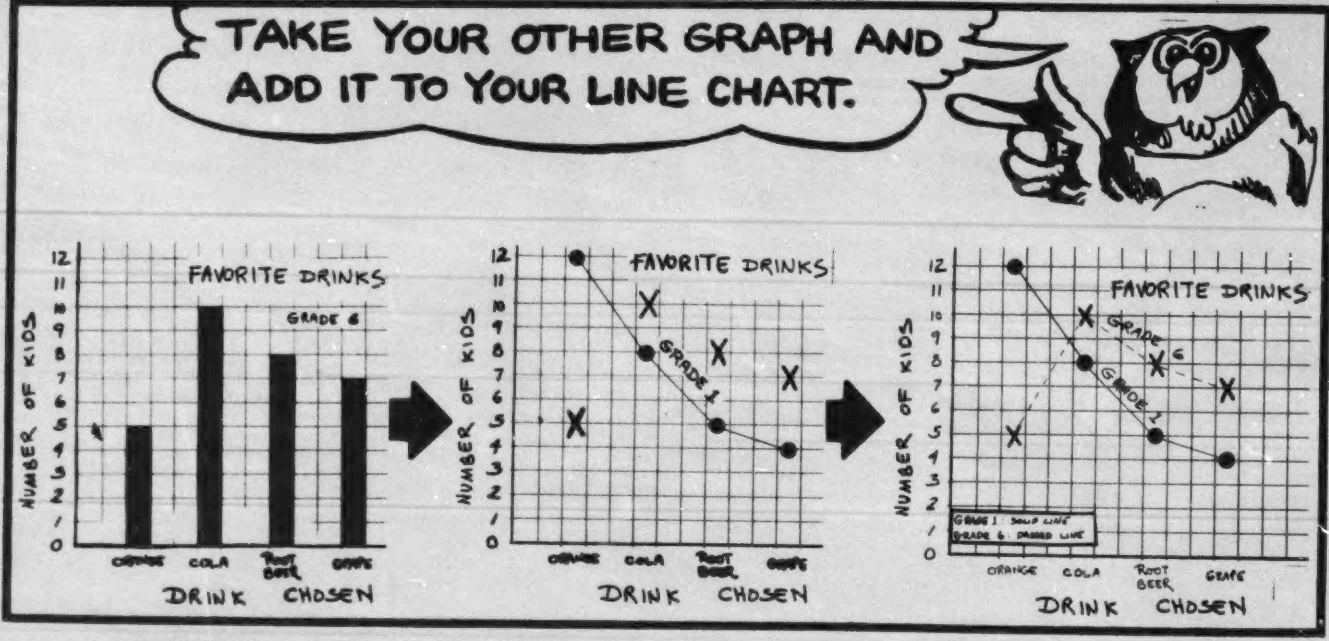
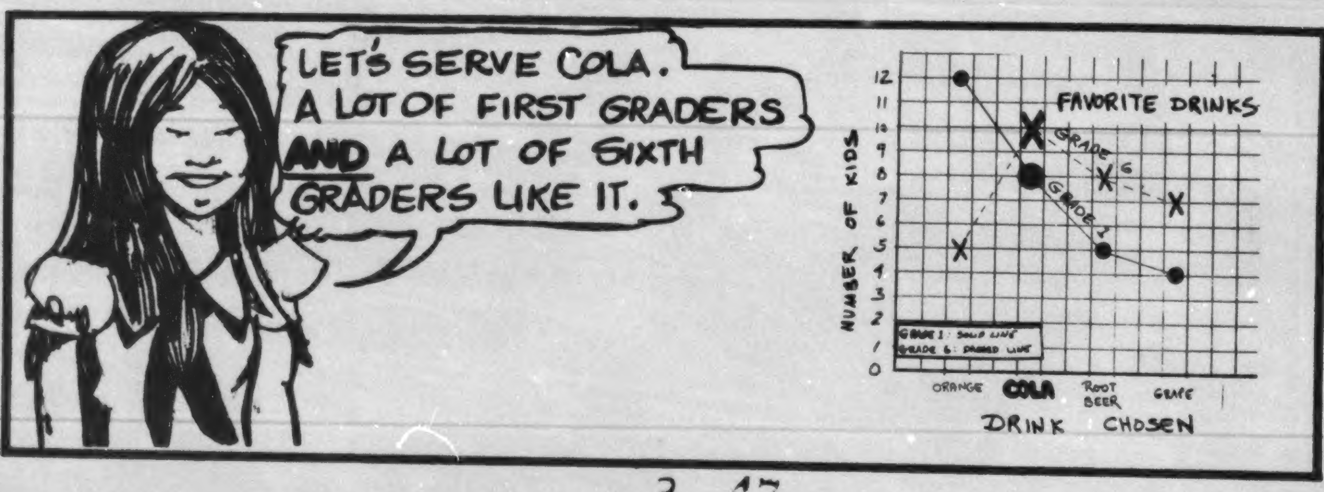
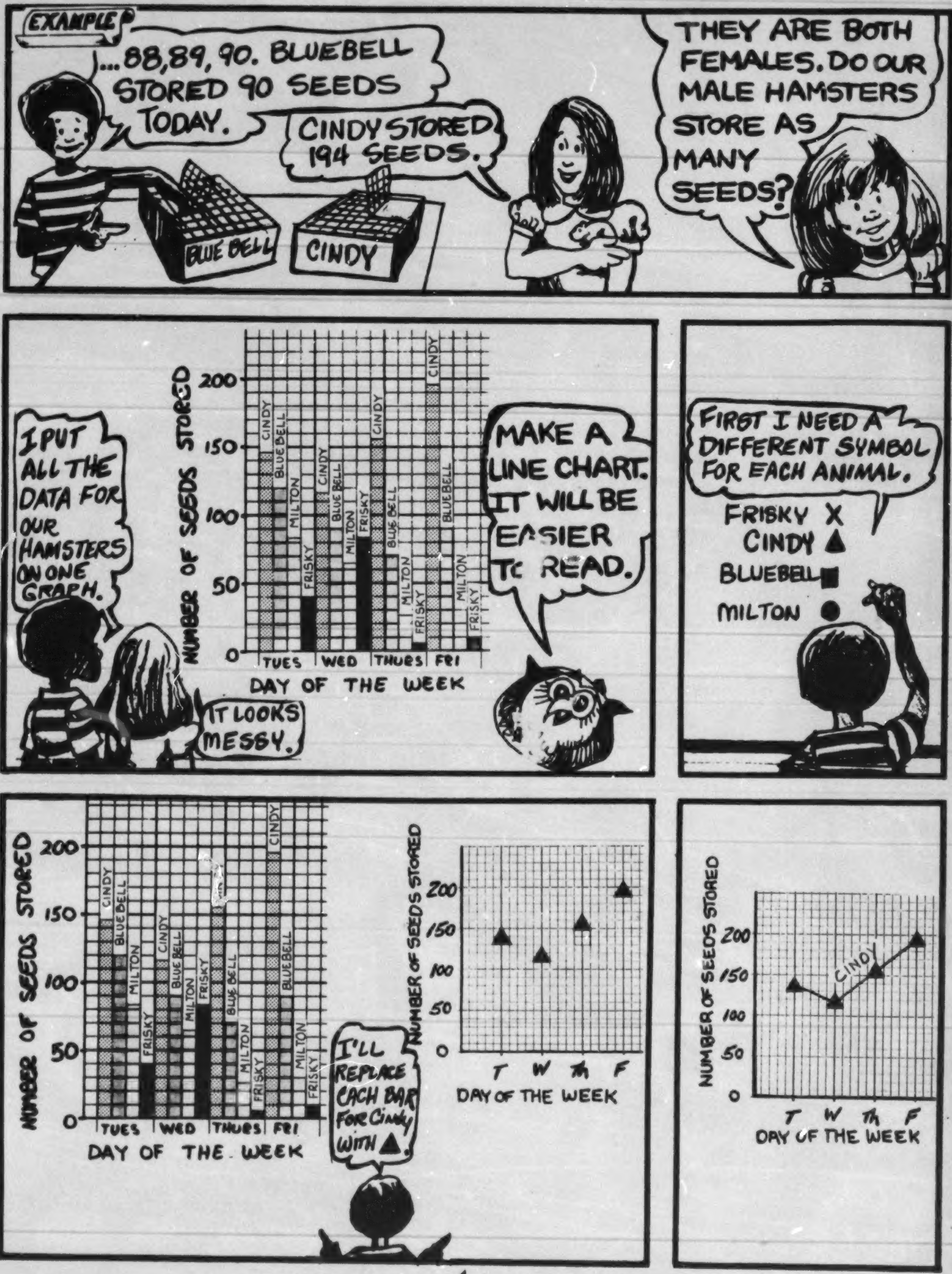
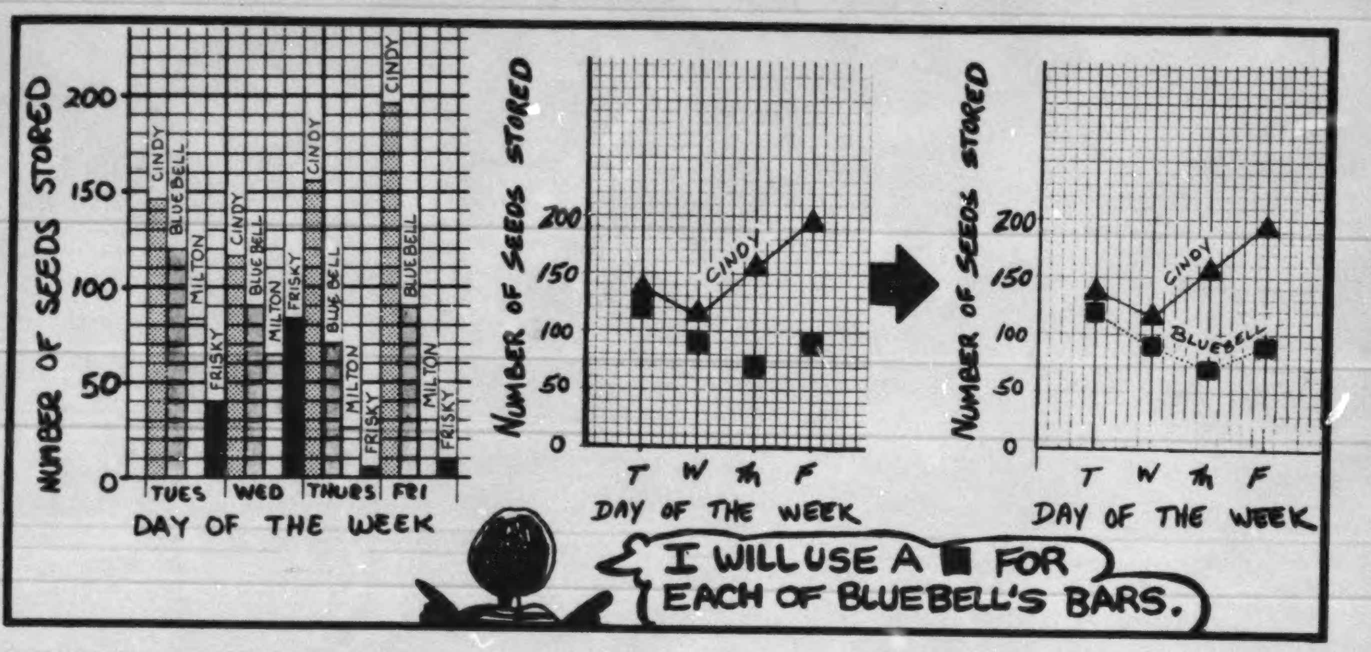

HOW DO I MAKE A LINE CHART?
FAVORITE DRINKS
GRADE 1
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
FAVORITE DRINKS
GRADE 6
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
FIRST, LOOK AT THE SCALES ON EACH GRAPH. MAKE SURE THEY ARE THE SAME.
FAVORITE DRINKS
GRADE 6
NUMBER OF KIDS
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
SAME
FAVORITE DRINKS
GRADE 1
NUMBER OF KIDS
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
NEXT, LOOK AT THE LABELS ON EACH GRAPH. MAKE SURE THEY ARE THE SAME.
NUMBER OF KIDS
FAVORITE DRINKS
GRADE 1
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
SAME
NUMBER OF KIDS
FAVORITE DRINKS
GRADE 6
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
SAME

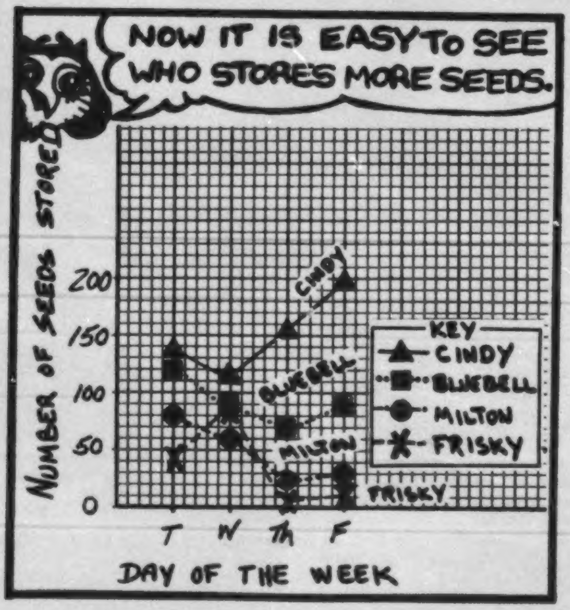

NOW, USE ONE BAR GRAPH TO MAKE A LINE CHART LIKE THIS.
DRAW LINES BETWEEN THE DOTS. IT MAKES THEM EASIER TO SEE.
FAVORITE DRINKS
GRADE 1
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
FAVORITE DRINKS
GRADE 1
FAVORITE DRINKS
GRADE 1

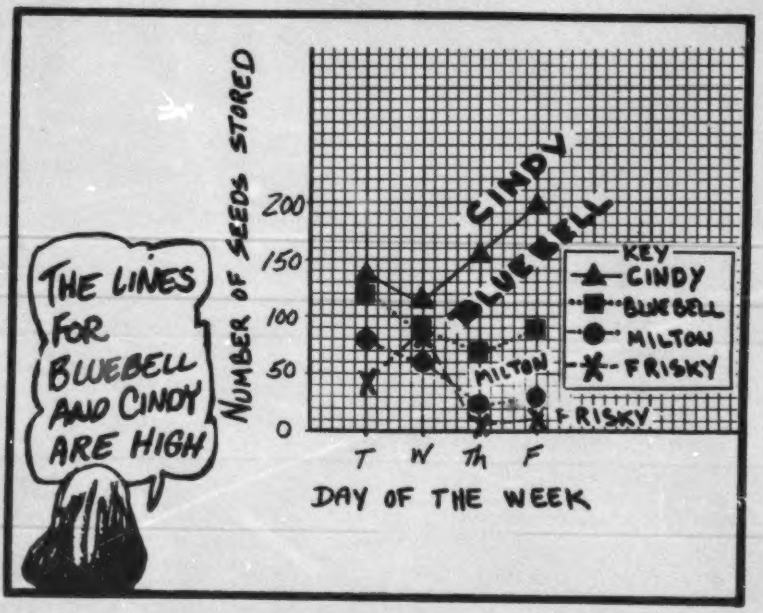

TAKE YOUR OTHER GRAPH AND ADD IT TO YOUR LINE CHART.
FAVORITE DRINKS
GRADE 6
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN
FAVORITE DRINKS
GRADE 1
FAVORITE DRINKS
GRADE 6
GRADE 1
GRADE 1: SOLID LINE
GRADE 6: DASHED LINE

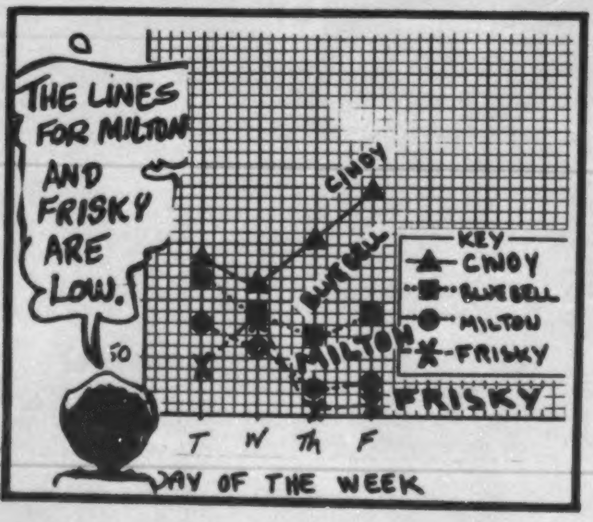

LET'S SERVE COLA. A LOT OF FIRST GRADERS AND A LOT OF SIXTH GRADERS LIKE IT.
FAVORITE DRINKS
GRADE 6
GRADE 1
NUMBER OF KIDS
0 1 2 3 4 5 6 7 8 9 10 11 12
GRADE 1: SOLID LINE
GRADE 6: DASHED LINE
ORANGE COLA ROOT BEER GRAPE
DRINK CHOSEN

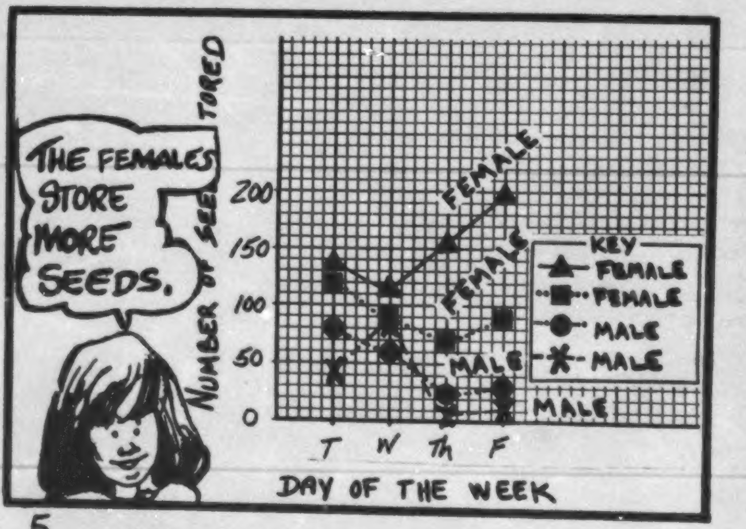

EXAMPLE
...88,89,90. BLUEBELL STORED 90 SEEDS TODAY.
CINDY STORED 194 SEEDS.
THEY ARE BOTH FEMALES. DO OUR MALE HAMSTERS STORE AS MANY SEEDS?
BLUE BELL
CINDY
I PUT ALL THE DATA FOR OUR HAMSTERS ON ONE GRAPH.
IT LOOKS MESSY.
NUMBER OF SEEDS STORED
0
50
100
150
200
CINDY
BLUE BELL
MILTON
FRISKY
TUES
WED
THURS
FRI
DAY OF THE WEEK
MAKE A LINE CHART. IT WILL BE EASIER TO READ.
FIRST I NEED A DIFFERENT SYMBOL FOR EACH ANIMAL.
FRISKY X
CINDY ▲
BLUEBELL ■
MILTON ●
I'LL REPLACE EACH BAR FOR Cindy WITH ▲.
T
W
Th
F
CINDY

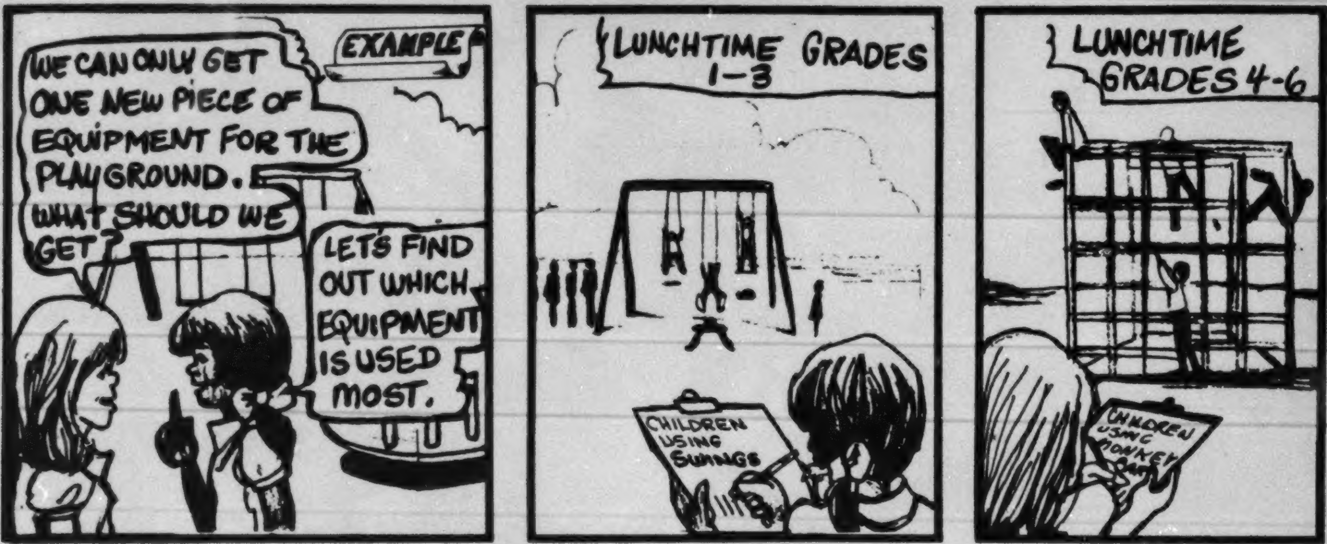

NUMBER OF SEEDS STORED
0
50
100
150
200
CINDY
BLUEBELL
MILTON
FRISKY
TUES
WED
THURS
FRI
DAY OF THE WEEK
NUMBER OF SEEDS STORED
0
50
100
150
200
CINDY
T
W
Th
F
DAY OF THE WEEK
NUMBER OF SEEDS STORED
0
50
100
150
200
CINDY
BLUEBELL
T
W
Th
F
DAY OF THE WEEK
I WILL USE A ■ FOR EACH OF BLUEBELL'S BARS.

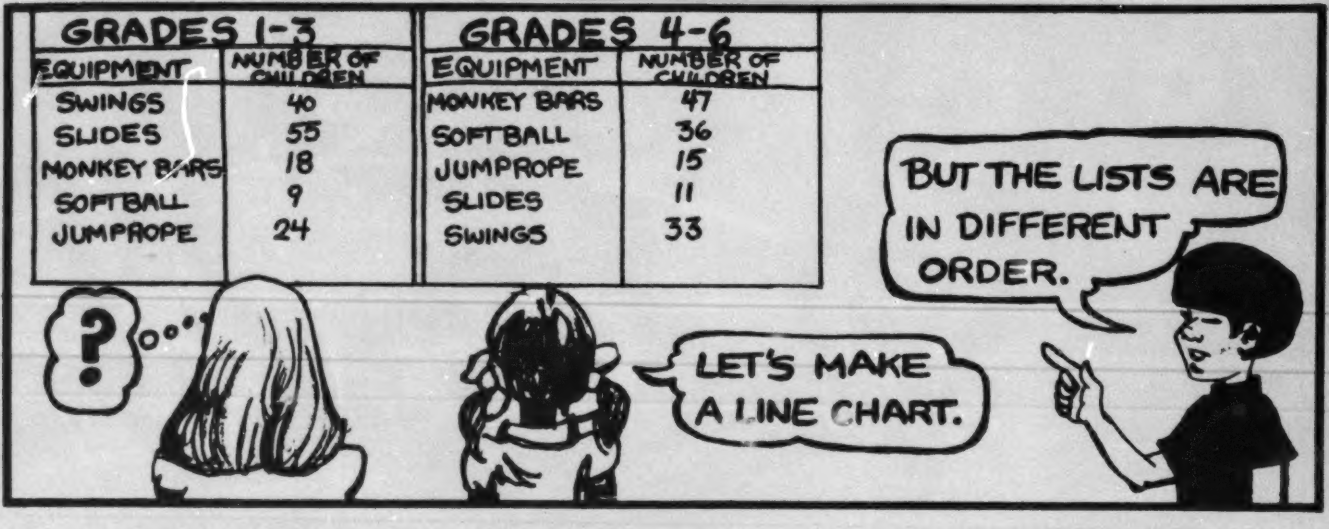

NOW IT IS EASY TO SEE WHO STORES MORE SEEDS.
NUMBER OF SEEDS STORED
0
50
100
150
200
CINDY
BLUEBELL
MILTON
FRISKY
KEY
▲ CINDY
■ BLUEBELL
● MILTON
✱ FRISKY
T
W
Th
F
DAY OF THE WEEK


THE LINES FOR BLUEBELL AND CINDY ARE HIGH
NUMBER OF SEEDS STORED
0
50
100
150
200
CINDY
BLUEBELL
MILTON
FRISKY
KEY
▲ CINDY
■ BLUEBELL
● MILTON
✱ FRISKY
T
W
Th
F
DAY OF THE WEEK


THE LINES FOR MILTON AND FRISKY ARE LOW.
50
CINDY
BLUEBELL
MILTON
FRISKY
KEY
▲ CINDY
■ BLUEBELL
● MILTON
✱ FRISKY
T
W
Th
F
DAY OF THE WEEK


THE FEMALES STORE MORE SEEDS.
NUMBER OF SEEDS STORED
0
50
100
150
200
FEMALE
FEMALE
MALE
MALE
KEY
▲ FEMALE
■ FEMALE
● MALE
✱ MALE
T
W
Th
F
DAY OF THE WEEK


EXAMPLE
WE CAN ONLY GET ONE NEW PIECE OF EQUIPMENT FOR THE PLAYGROUND. WHAT SHOULD WE GET?
LET'S FIND OUT WHICH EQUIPMENT IS USED MOST.
LUNCHTIME GRADES 1-3
CHILDREN USING SWINGS
LUNCHTIME GRADES 4-6
CHILDREN USING MONKEY BARS



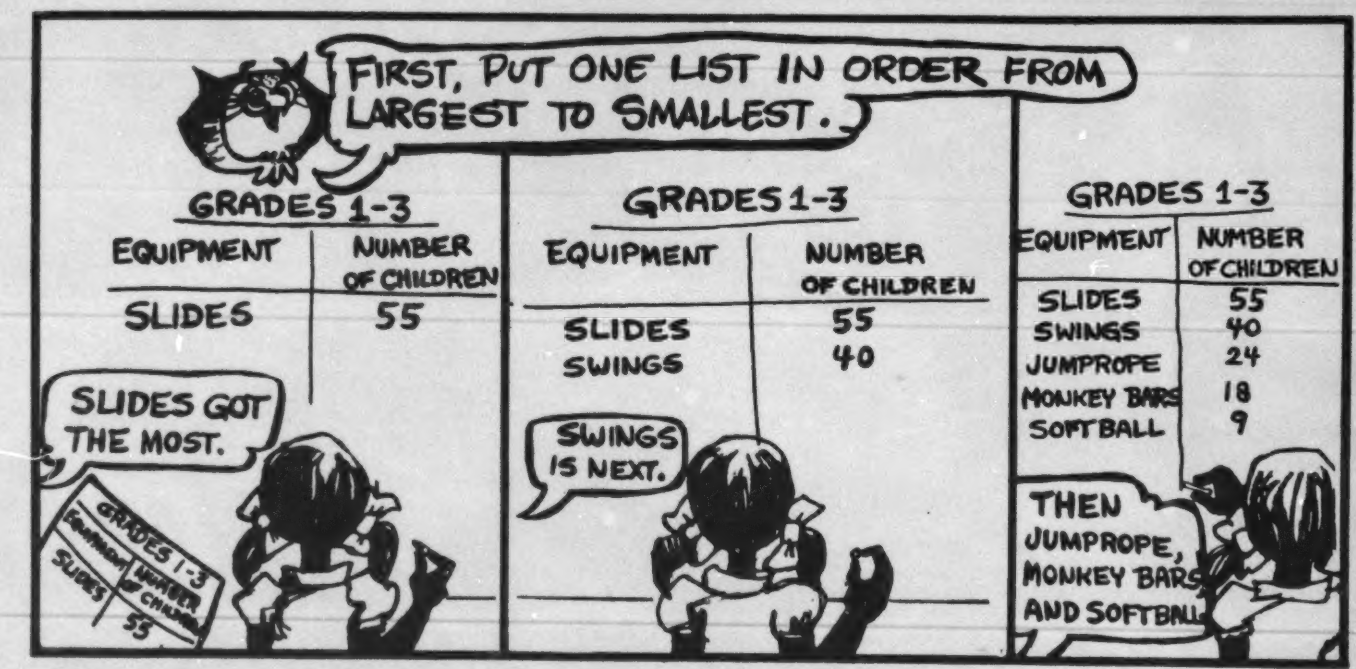
GRADES 1-3

EQUIPMENT	NUMBER OF CHILDREN
SWINGS	40
SLIDES	55
MONKEY BARS	18
SOFTBALL	9
JUMPROPE	24

GRADES 4-6

EQUIPMENT	NUMBER OF CHILDREN
MONKEY BARS	47
SOFTBALL	36
JUMPROPE	15
SLIDES	11
SWINGS	33

?
BUT THE LISTS ARE IN DIFFERENT ORDER.
LET'S MAKE A LINE CHART.


FIRST, PUT ONE LIST IN ORDER FROM LARGEST TO SMALLEST.

GRADES 1-3

EQUIPMENT	NUMBER OF CHILDREN
SLIDES	55

SLIDES GOT THE MOST.
GRADES 1-3 EQUIPMENT NUMBER OF CHILDREN SLIDES 55

GRADES 1-3

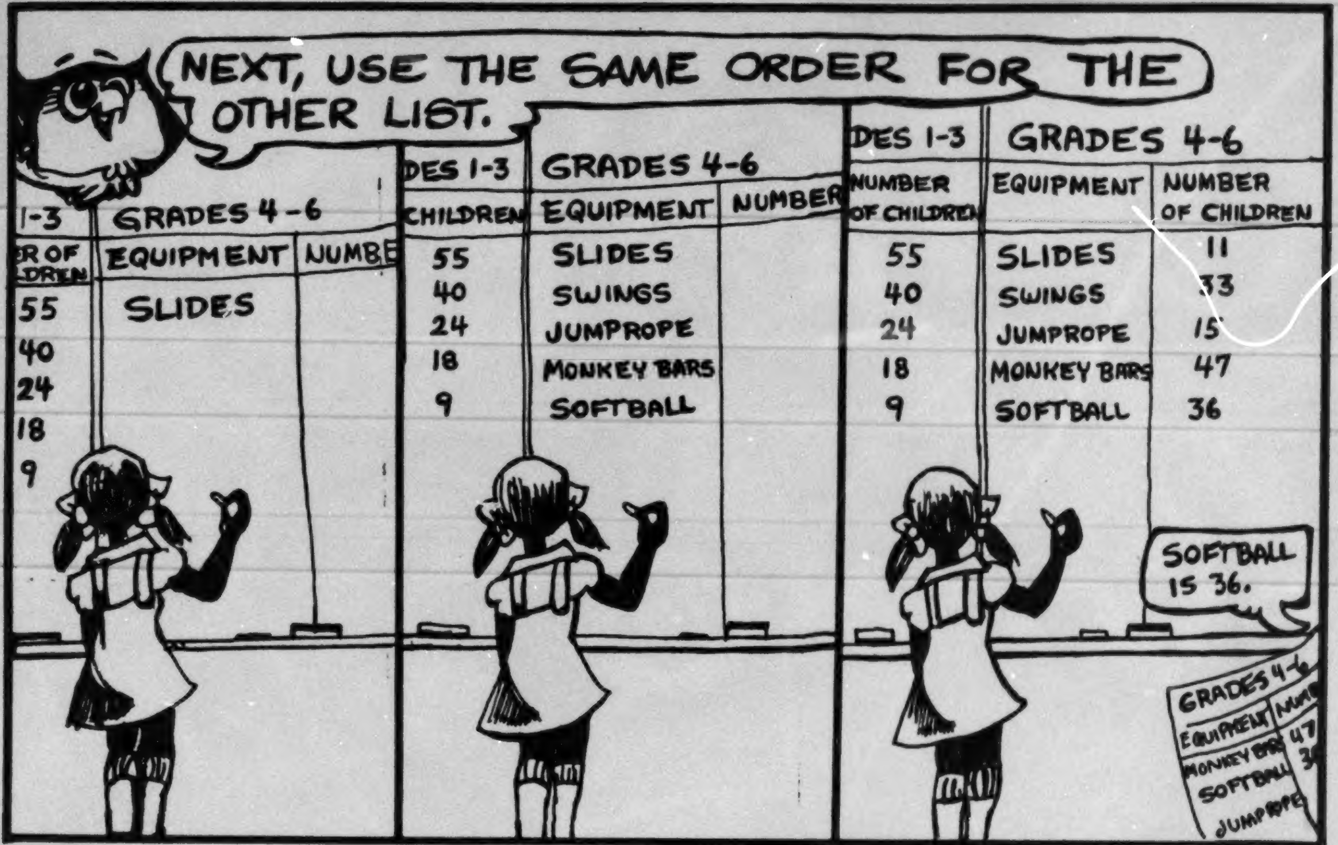
EQUIPMENT	NUMBER OF CHILDREN
SLIDES	55
SWINGS	40

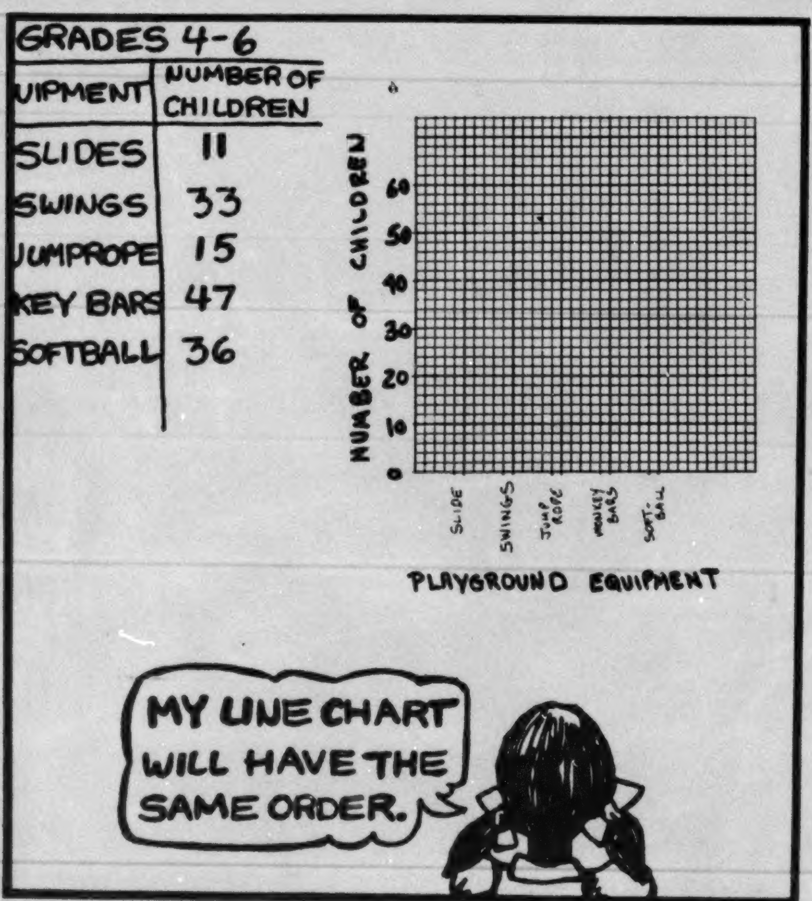
SWINGS IS NEXT.

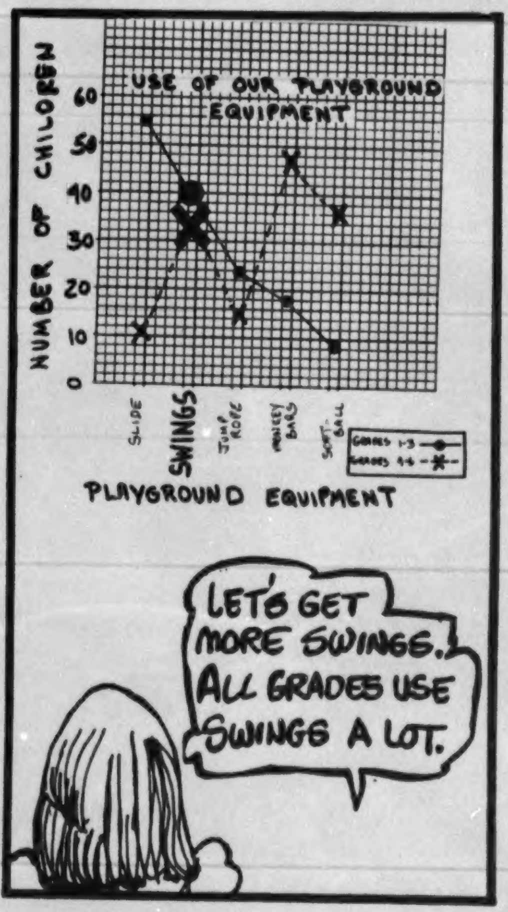
GRADES 1-3

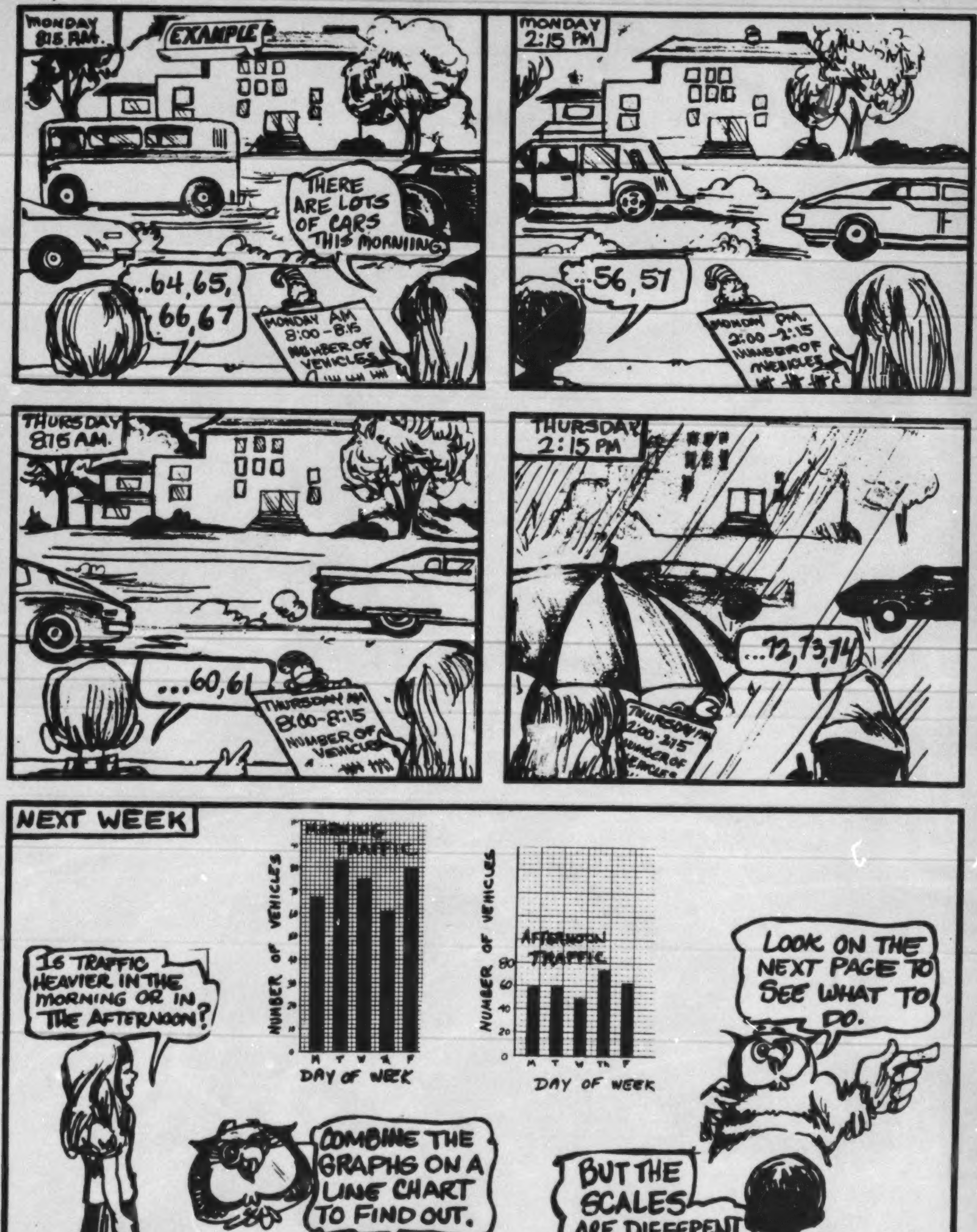
EQUIPMENT	NUMBER OF CHILDREN
SLIDES	55
SWINGS	40
JUMPROPE	24
MONKEY BARS	18
SOFTBALL	9

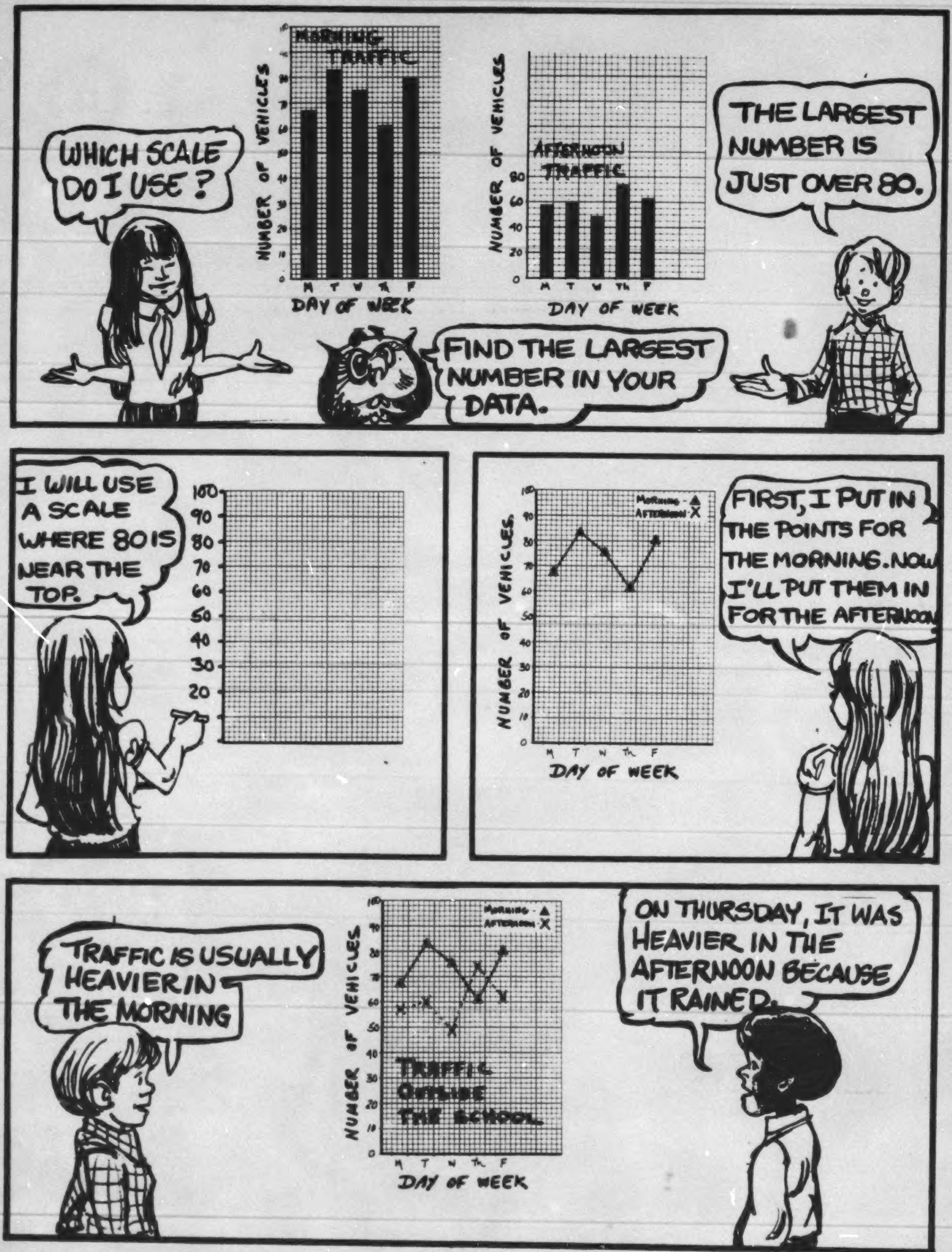
THEN JUMPROPE, MONKEY BARS AND SOFTBALL

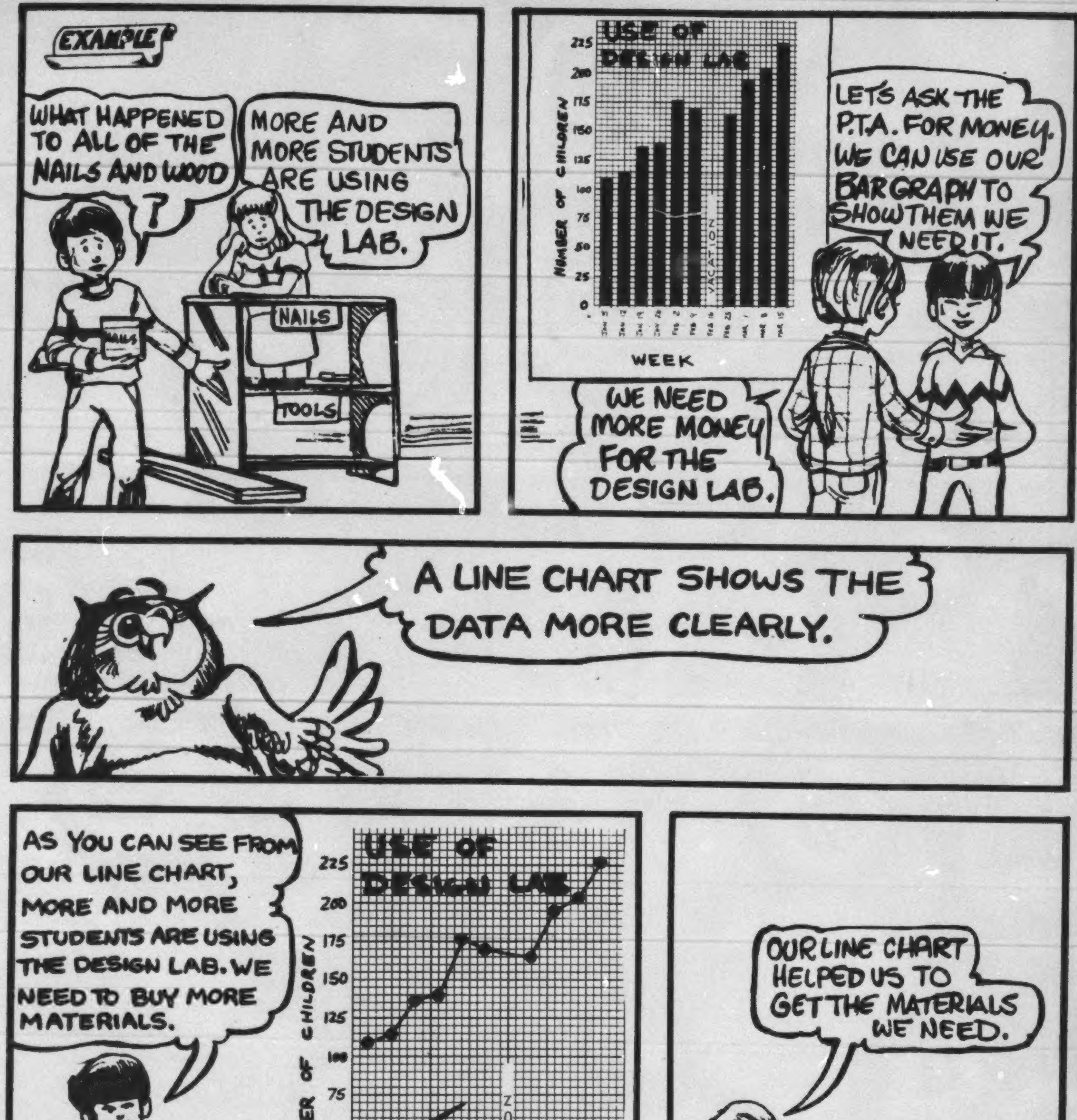

NEXT, USE THE SAME ORDER FOR THE OTHER LIST.
1-3 | GRADES 4-6
ER OF LDREN | EQUIPMENT | NUMBE
55 SLIDES
40
24
18
9
DES 1-3 | GRADES 4-6
CHILDREN | EQUIPMENT | NUMBER
55 SLIDES
40 SWINGS
24 JUMPROPE
18 MONKEY BARS
9 SOFTBALL
DES 1-3 | GRADES 4-6
NUMBER OF CHILDREN | EQUIPMENT | NUMBER OF CHILDREN
55 SLIDES 11
40 SWINGS 33
24 JUMPROPE 15
18 MONKEY BARS 47
9 SOFTBALL 36
SOFTBALL IS 36.
GRADES 4-6
EQUIPMENT NUMB
MONKEY BARS 47
SOFTBALL 36
JUMPROPE

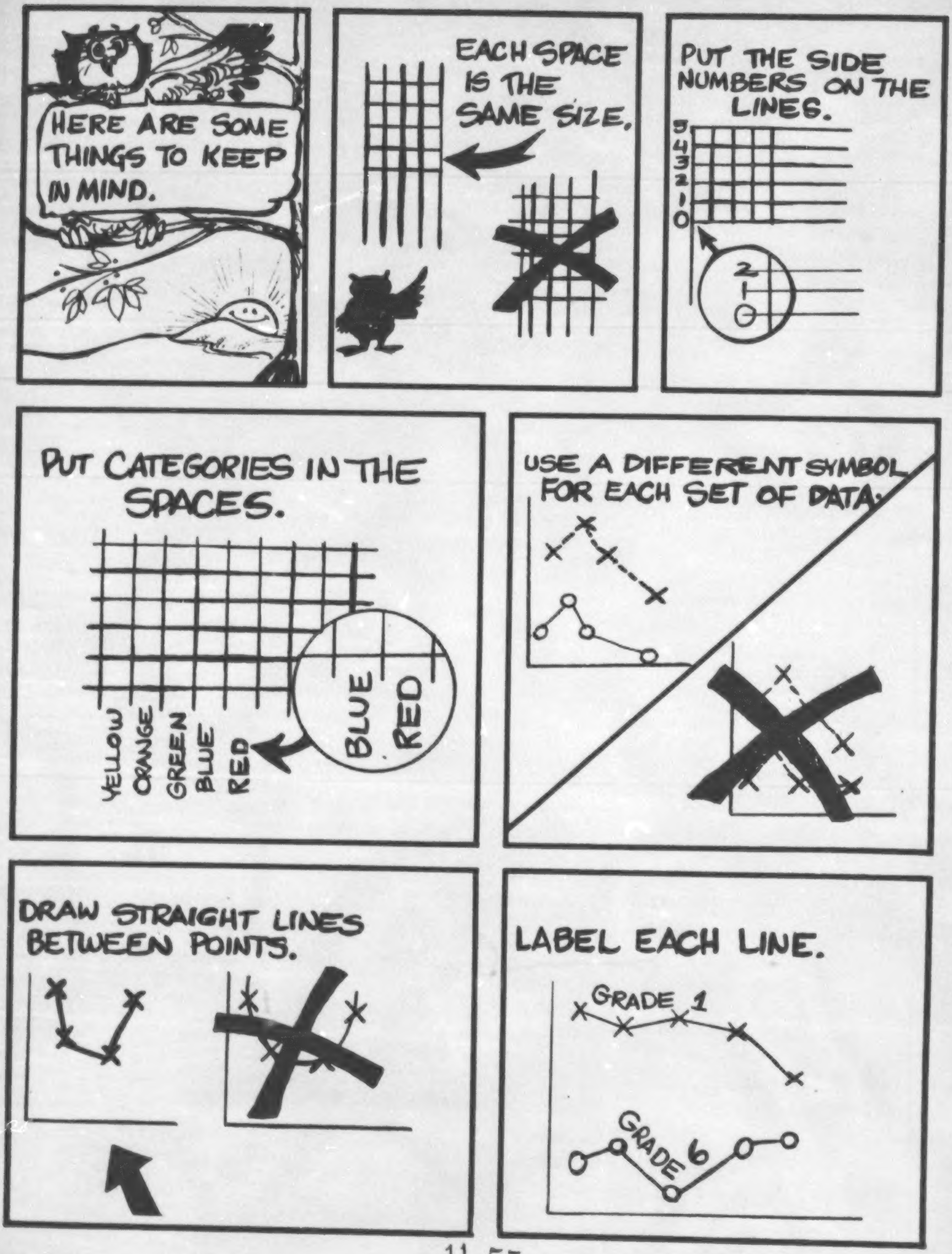

GRADES 4-6
UIPMENT | NUMBER OF CHILDREN
SLIDES 11
SWINGS 33
JUMPROPE 15
KEY BARS 47
SOFTBALL 36
NUMBER OF CHILDREN
0
10
20
30
40
50
60
SLIDE
SWINGS
JUMP ROPE
MONKEY BARS
SOFT-BALL
PLAYGROUND EQUIPMENT
MY LINE CHART WILL HAVE THE SAME ORDER.

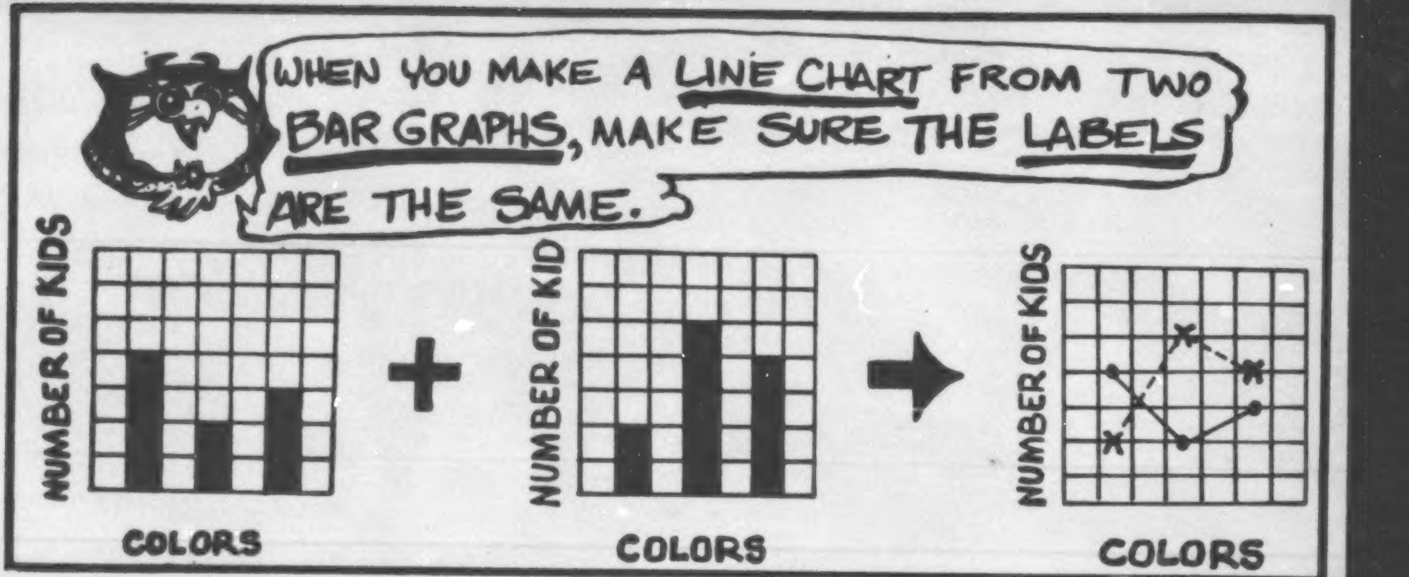

USE OF OUR PLAYGROUND EQUIPMENT
NUMBER OF CHILDREN
0
10
20
30
40
50
60
SLIDE
SWINGS
JUMP ROPE
MONKEY BARS
SOFT-BALL
GRADES 1-3
GRADES 4-6
PLAYGROUND EQUIPMENT
LET'S GET MORE SWINGS. ALL GRADES USE SWINGS A LOT.

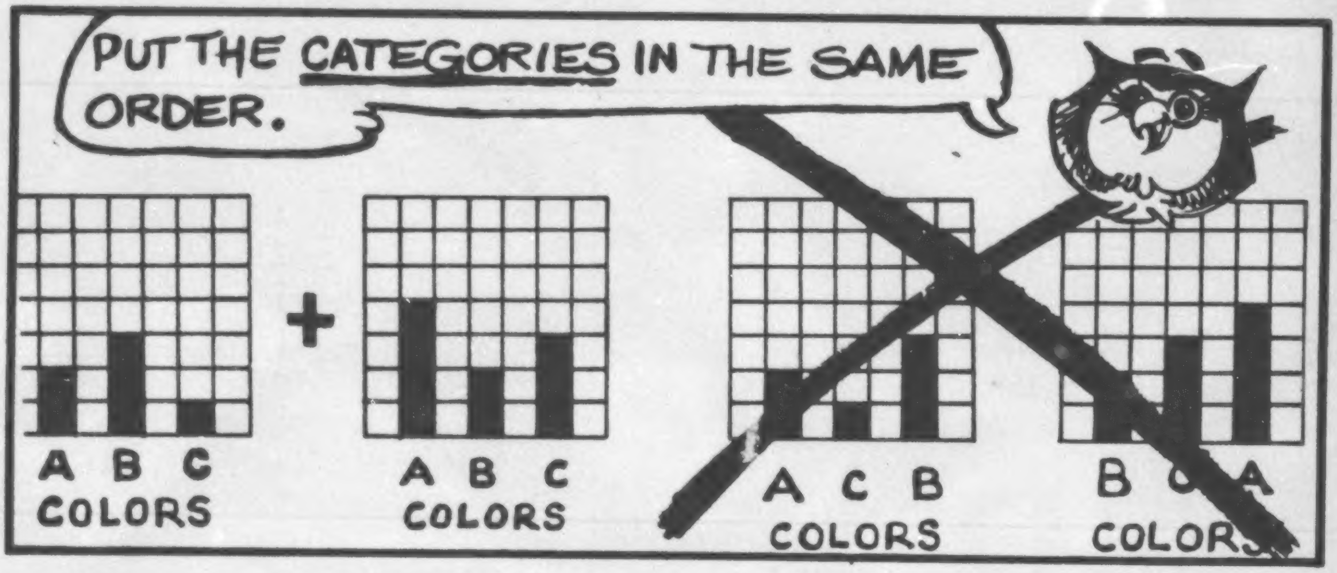

MONDAY 8:15 AM.
EXAMPLE
THERE ARE LOTS OF CARS THIS MORNING.
...64, 65, 66, 67
MONDAY AM 8:00 - 8:15 NUMBER OF VEHICLES
MONDAY 2:15 PM
...56, 57
MONDAY PM. 2:00 - 2:15 NUMBER OF VEHICLES
THURSDAY 8:15 AM.
...60, 61
THURSDAY AM 8:00 - 8:15 NUMBER OF VEHICLES
THURSDAY 2:15 PM
...72, 73, 74
THURSDAY PM 2:00 - 2:15 NUMBER OF VEHICLES
NEXT WEEK
IS TRAFFIC HEAVIER IN THE MORNING OR IN THE AFTERNOON?
MORNING TRAFFIC
NUMBER OF VEHICLES
0
M T W Th F
DAY OF WEEK
AFTERNOON TRAFFIC
NUMBER OF VEHICLES
0 20 40 60 80
M T W Th F
DAY OF WEEK
LOOK ON THE NEXT PAGE TO SEE WHAT TO DO.
COMBINE THE GRAPHS ON A LINE CHART TO FIND OUT.
BUT THE SCALES ARE DIFFERENT.

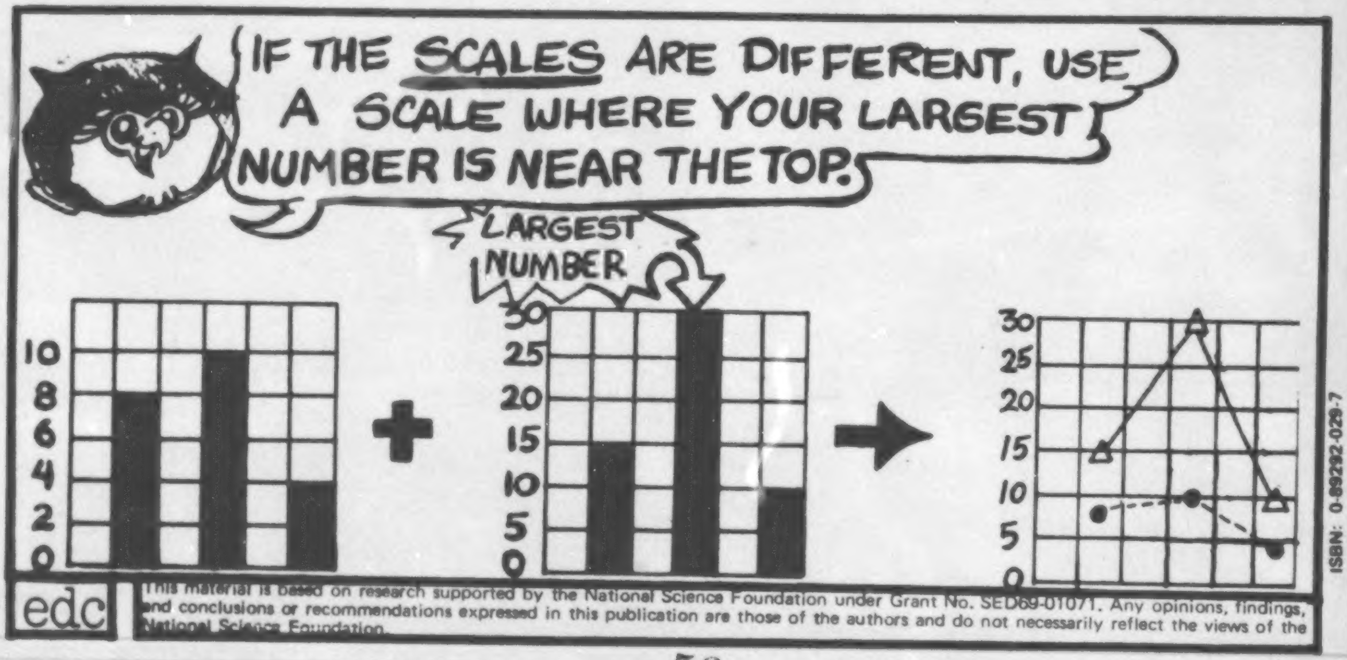

WHICH SCALE DO I USE?
MORNING TRAFFIC
NUMBER OF VEHICLES
DAY OF WEEK
M T W Th F
AFTERNOON TRAFFIC
0 20 40 60 80
THE LARGEST NUMBER IS JUST OVER 80.
FIND THE LARGEST NUMBER IN YOUR DATA.
I WILL USE A SCALE WHERE 80 IS NEAR THE TOP.
100 90 80 70 60 50 40 30 20
FIRST, I PUT IN THE POINTS FOR THE MORNINGS. NOW I'LL PUT THEM IN FOR THE AFTERNOON
MORNING - ▲
AFTERNOON - X
0 10 20 30 40 50 60 70 80 90 100
TRAFFIC IS USUALLY HEAVIER IN THE MORNING
TRAFFIC OUTSIDE THE SCHOOL
ON THURSDAY, IT WAS HEAVIER IN THE AFTERNOON BECAUSE IT RAINED.


EXAMPLE
WHAT HAPPENED TO ALL OF THE NAILS AND WOOD?
MORE AND MORE STUDENTS ARE USING THE DESIGN LAB.
NAILS
NAILS
TOOLS
USE OF DESIGN LAB
NUMBER OF CHILDREN
0 25 50 75 100 125 150 175 200 225
JAN 5 JAN 12 JAN 19 JAN 26 FEB 2 FEB 9 FEB 16 FEB 23 MAR 1 MAR 8 MAR 15
VACATION
WEEK
LET'S ASK THE P.T.A. FOR MONEY. WE CAN USE OUR BAR GRAPH TO SHOW THEM WE NEED IT.
WE NEED MORE MONEY FOR THE DESIGN LAB.
A LINE CHART SHOWS THE DATA MORE CLEARLY.
AS YOU CAN SEE FROM OUR LINE CHART, MORE AND MORE STUDENTS ARE USING THE DESIGN LAB. WE NEED TO BUY MORE MATERIALS.
USE OF DESIGN LAB
NUMBER OF CHILDREN
0 25 50 75 100 125 150 175 200 225
JAN 5 JAN 12 JAN 19 JAN 26 FEB 2 FEB 9 FEB 16 FEB 23 MAR 1 MAR 8 MAR 15
VACATION
WEEK
OUR LINE CHART HELPED US TO GET THE MATERIALS WE NEED.
NAILS
TOOLS


HERE ARE SOME THINGS TO KEEP IN MIND.
EACH SPACE IS THE SAME SIZE.
PUT THE SIDE NUMBERS ON THE LINES.
5
4
3
2
1
0
2
1
0
PUT CATEGORIES IN THE SPACES.
YELLOW
ORANGE
GREEN
BLUE
RED
BLUE
RED
USE A DIFFERENT SYMBOL FOR EACH SET OF DATA.
DRAW STRAIGHT LINES BETWEEN POINTS.
LABEL EACH LINE.
GRADE 1
GRADE 6


WHEN YOU MAKE A LINE CHART FROM TWO BAR GRAPHS, MAKE SURE THE LABELS ARE THE SAME.
NUMBER OF KIDS
COLORS
+
NUMBER OF KID
COLORS
NUMBER OF KIDS
COLORS


PUT THE CATEGORIES IN THE SAME ORDER.
A B C
COLORS
+
A B C
COLORS
A C B
COLORS
B C A
COLORS


IF THE SCALES ARE DIFFERENT, USE A SCALE WHERE YOUR LARGEST NUMBER IS NEAR THE TOP.
LARGEST NUMBER
10
8
6
4
2
0
+
30
25
20
15
10
5
0
30
25
20
15
10
5
0

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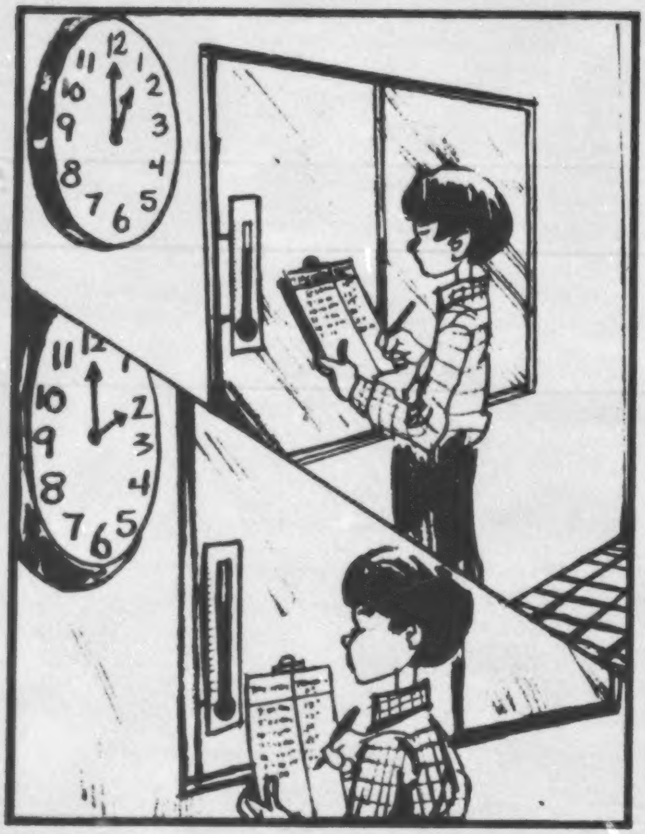
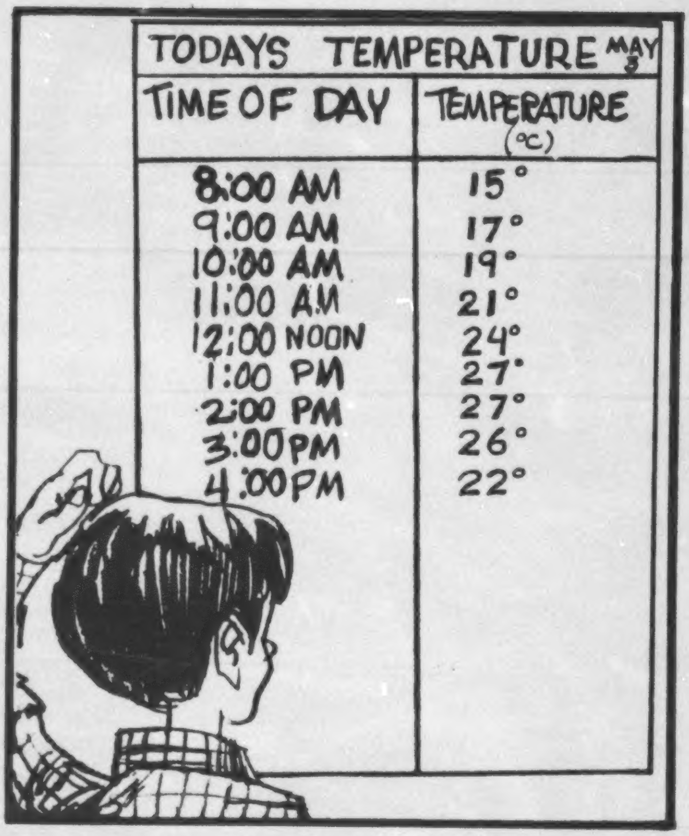
HOW TO

MAKE A LINE GRAPH

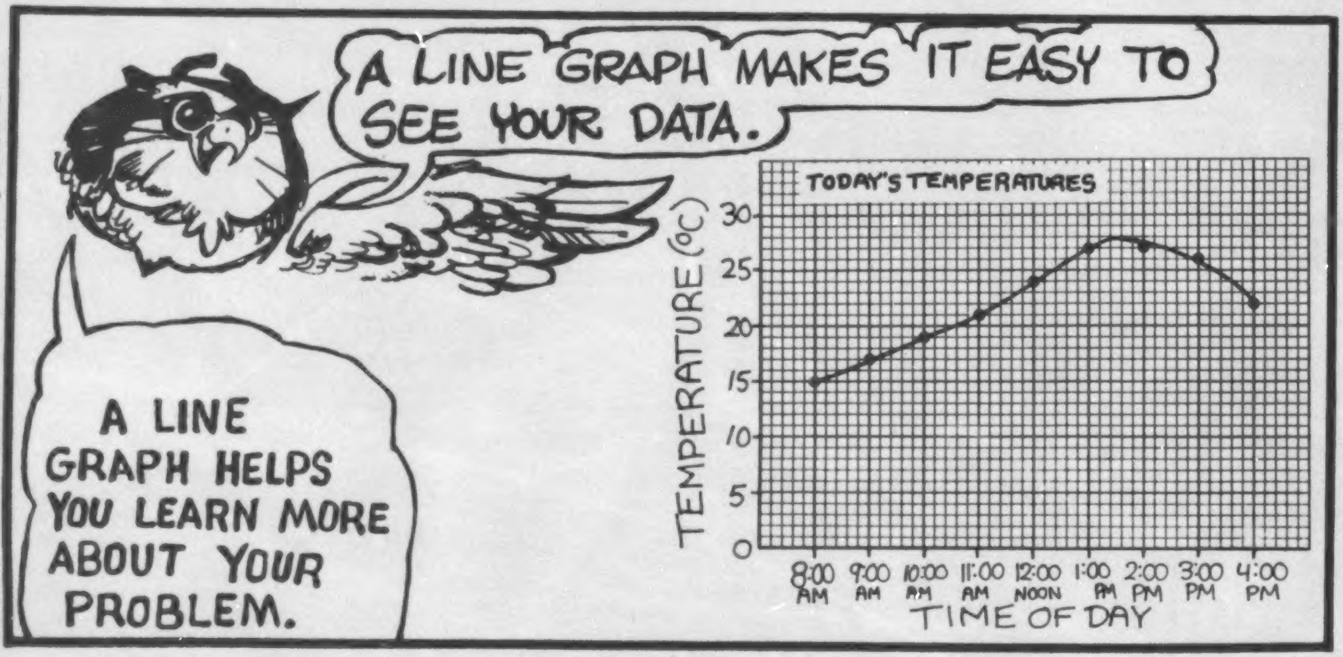
USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS





TODAYS TEMPERATURE MAY 3

TIME OF DAY	TEMPERATURE (°C)
8:00 AM	15°
9:00 AM	17°
10:00 AM	19°
11:00 AM	21°
12:00 NOON	24°
1:00 PM	27°
2:00 PM	27°
3:00 PM	26°
4:00 PM	22°



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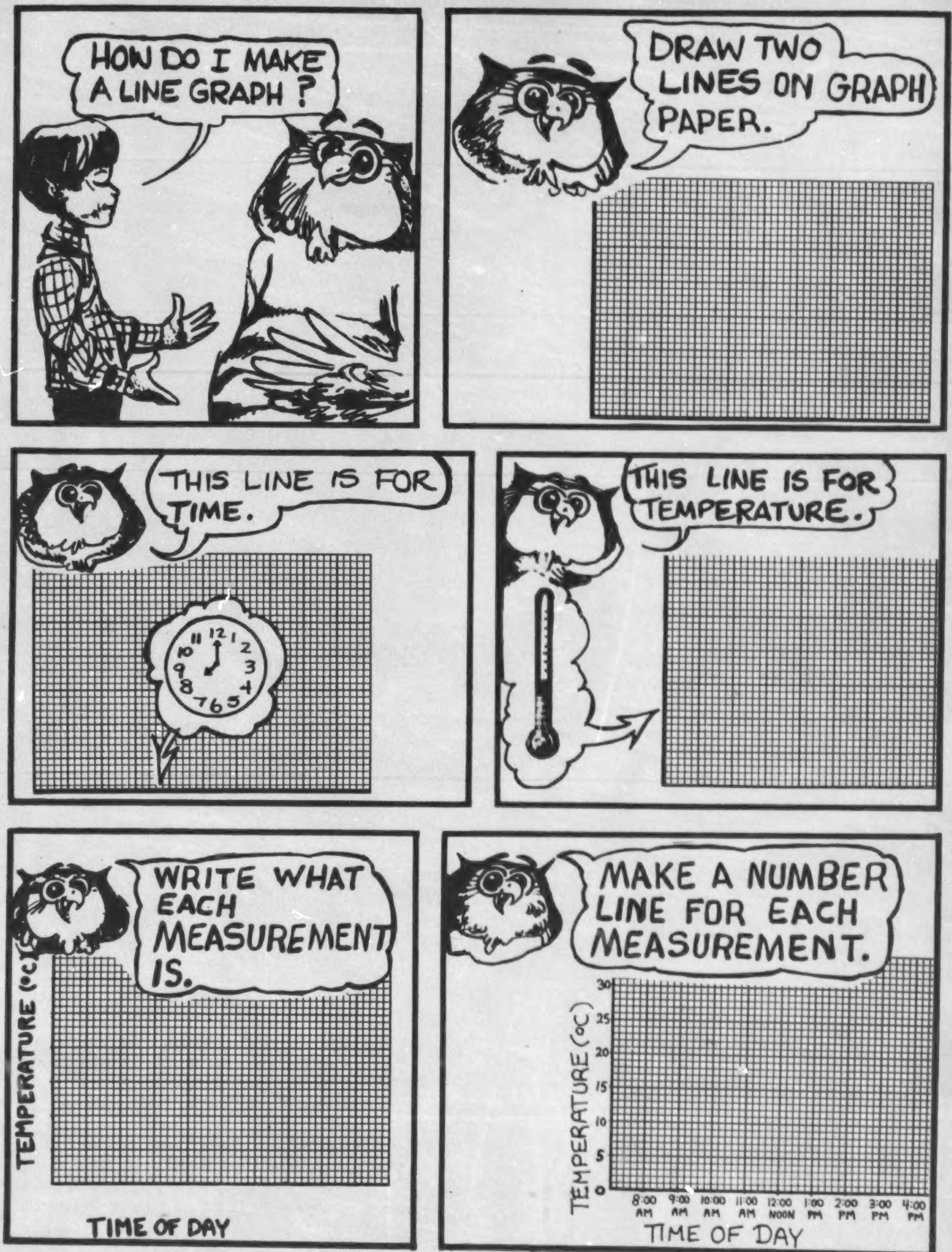
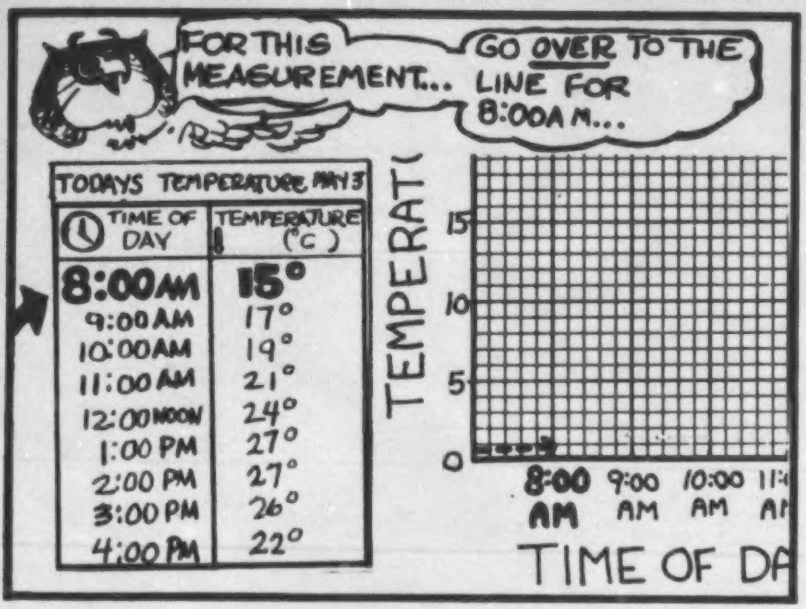
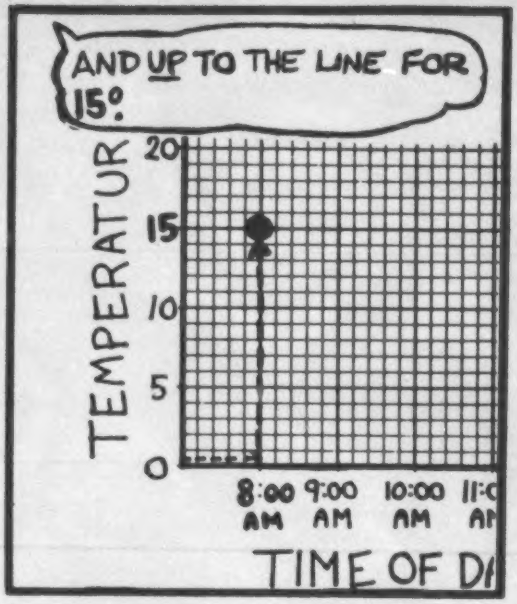
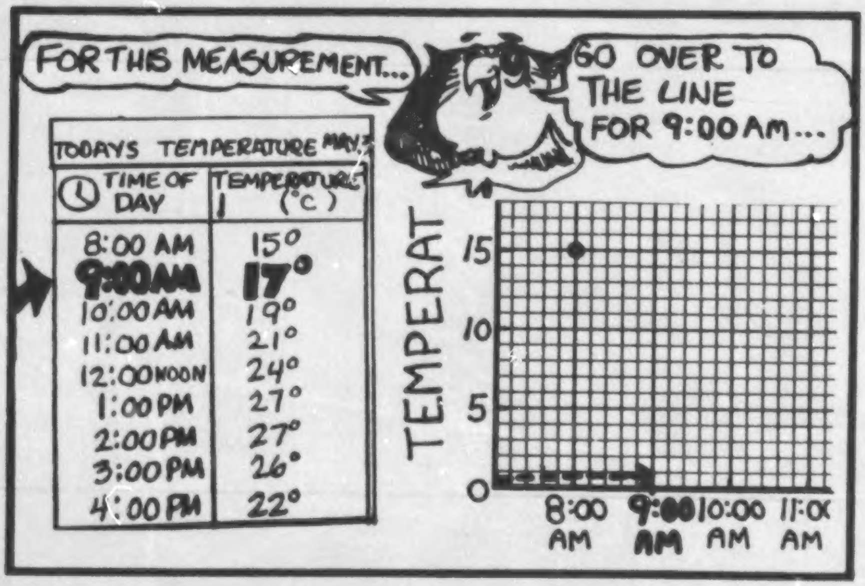

HOW DO I MAKE A LINE GRAPH?
DRAW TWO LINES ON GRAPH PAPER.
THIS LINE IS FOR TIME.
12
1
2
3
4
5
6
7
8
9
10
11
THIS LINE IS FOR TEMPERATURE.
WRITE WHAT EACH MEASUREMENT IS.
TEMPERATURE (°C)
TIME OF DAY
MAKE A NUMBER LINE FOR EACH MEASUREMENT.
TEMPERATURE (°C)
30
25
20
15
10
5
0
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 NOON
1:00 PM
2:00 PM
3:00 PM
4:00 PM
TIME OF DAY


FOR THIS MEASUREMENT...
GO OVER TO THE LINE FOR 8:00 AM...
TEMPERAT
15
10
5
0
8:00 AM
9:00 AM
10:00 AM
11:
TIME OF DA

TODAYS TEMPERATURE MAY 3

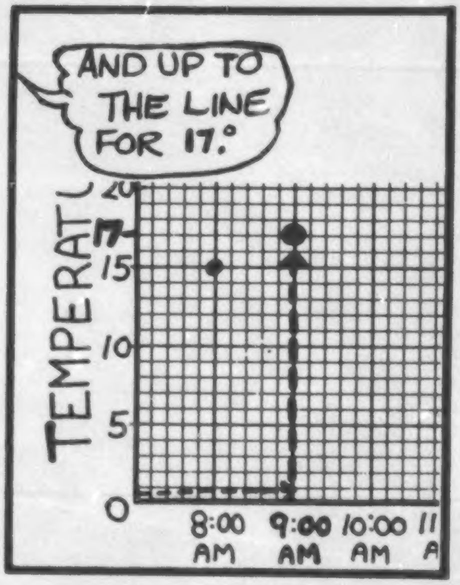
TIME OF DAY	TEMPERATURE (°C)
8:00 AM	**15°**
9:00 AM	17°
10:00 AM	19°
11:00 AM	21°
12:00 NOON	24°
1:00 PM	27°
2:00 PM	27°
3:00 PM	26°
4:00 PM	22°

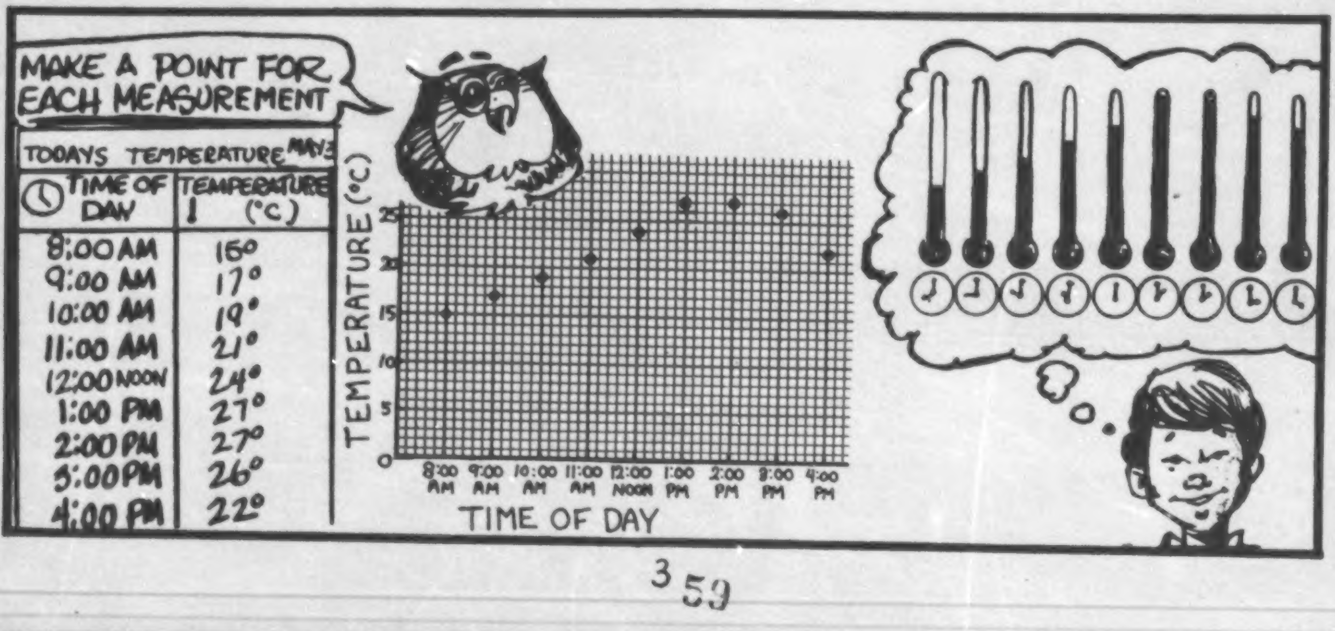

AND UP TO THE LINE FOR 15°
TEMPERATUR
20
15
10
5
0
8:00 AM
9:00 AM
10:00 AM
11:
TIME OF DA


FOR THIS MEASUREMENT...
GO OVER TO THE LINE FOR 9:00 AM...
TEMPERAT
15
10
5
0
8:00 AM
9:00 AM
10:00 AM
11:00 AM

TODAYS TEMPERATURE MAY 3

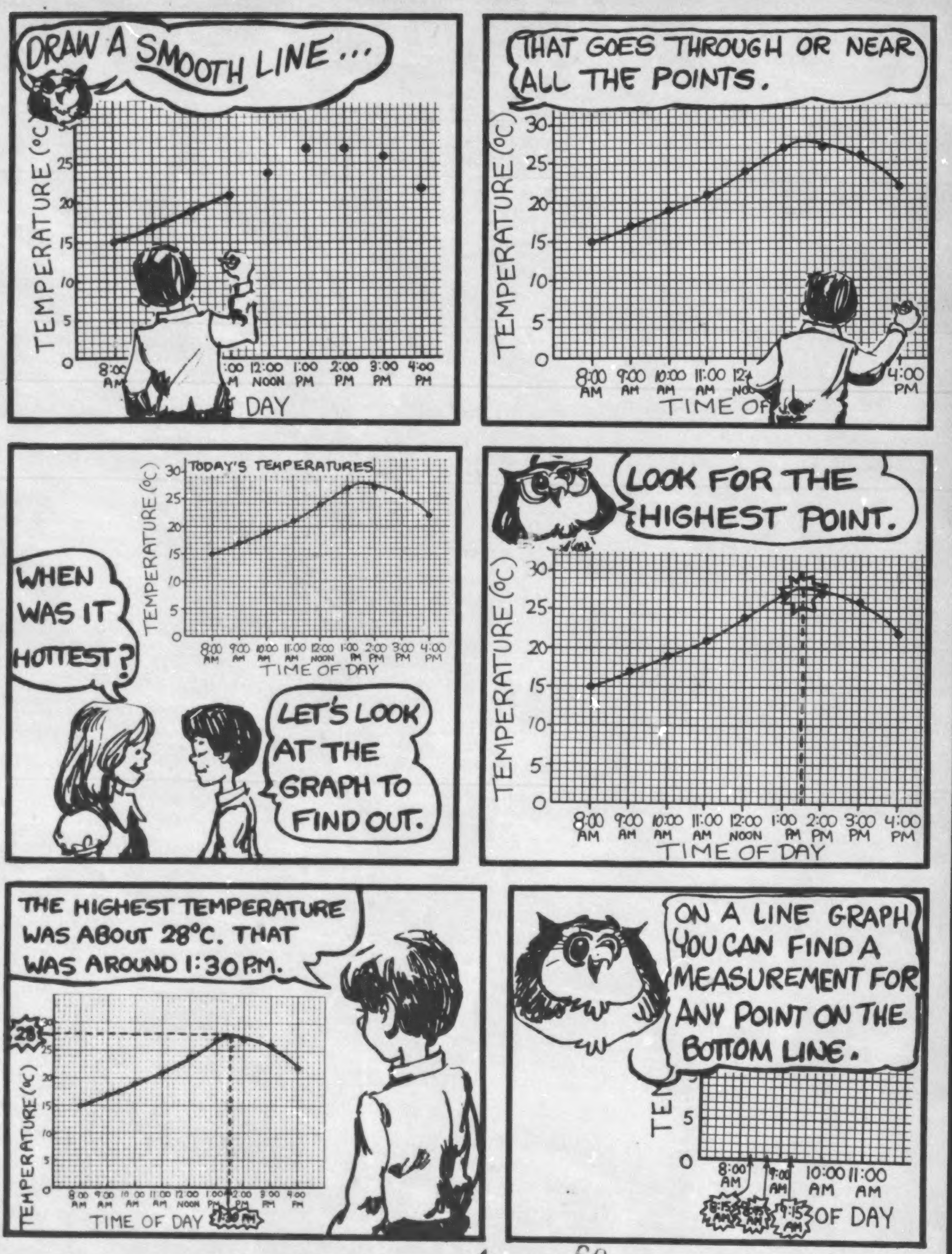
TIME OF DAY	TEMPERATURE (°C)
8:00 AM	15°
9:00 AM	**17°**
10:00 AM	19°
11:00 AM	21°
12:00 NOON	24°
1:00 PM	27°
2:00 PM	27°
3:00 PM	26°
4:00 PM	22°

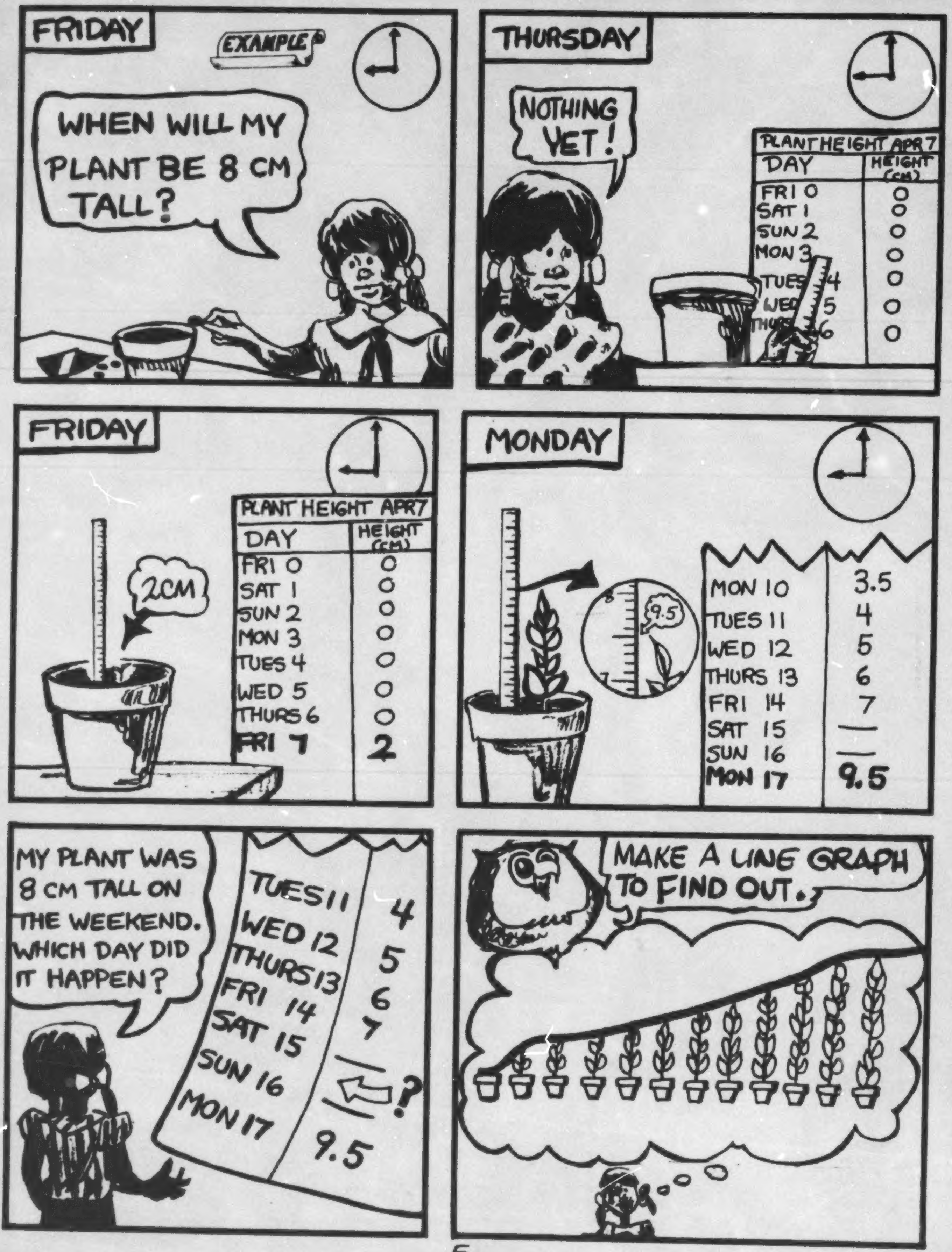

AND UP TO THE LINE FOR 17°
TEMPERAT
20
17
15
10
5
0
8:00 AM
9:00 AM
10:00 AM
11 A

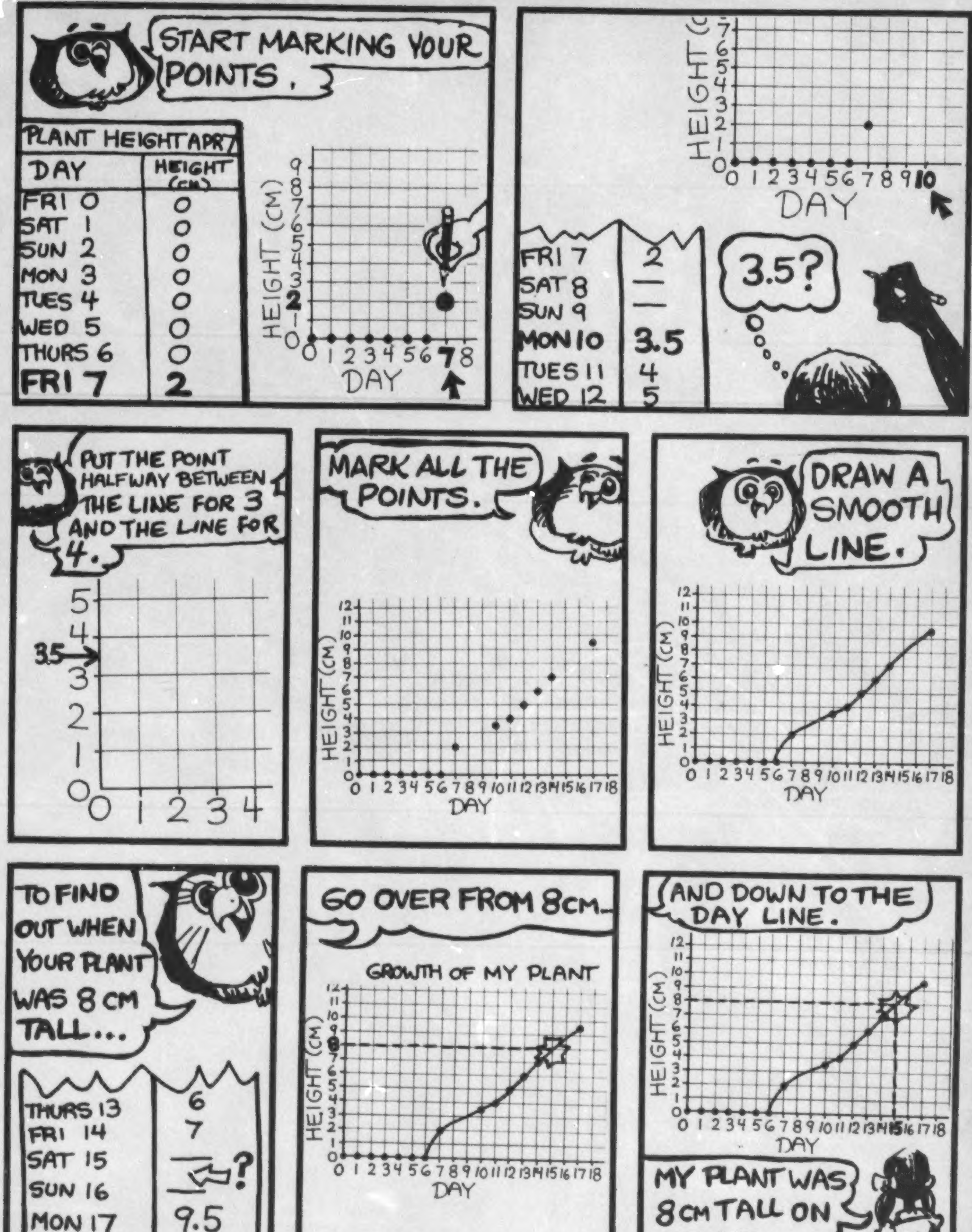

MAKE A POINT FOR EACH MEASUREMENT
TEMPERATURE (°C)
25
20
15
10
5
0
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 NOON
1:00 PM
2:00 PM
3:00 PM
4:00 PM
TIME OF DAY

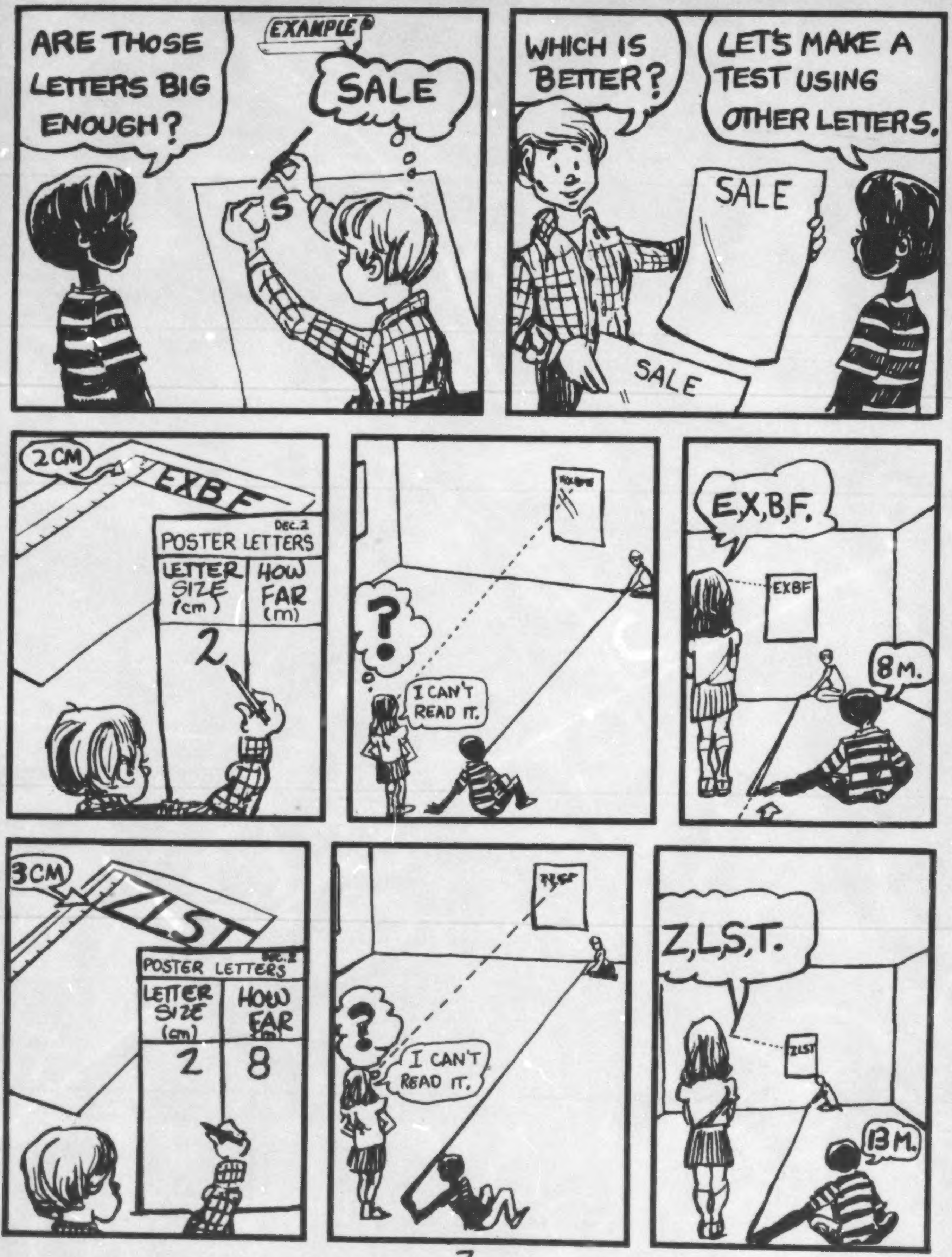
TODAYS TEMPERATURE MAY 3

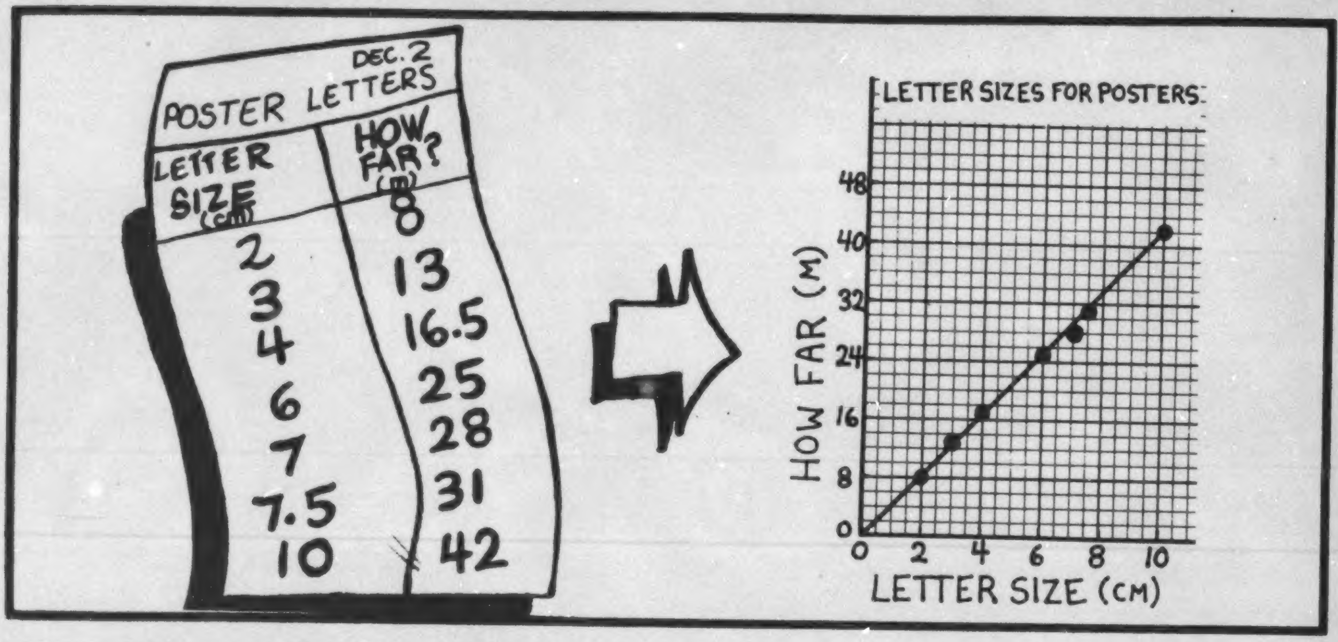
TIME OF DAY	TEMPERATURE (°C)
8:00 AM	15°
9:00 AM	17°
10:00 AM	19°
11:00 AM	21°
12:00 NOON	24°
1:00 PM	27°
2:00 PM	27°
3:00 PM	26°
4:00 PM	22°


DRAW A SMOOTH LINE...
THAT GOES THROUGH OR NEAR ALL THE POINTS.
TEMPERATURE (°C)
TIME OF DAY
TODAY'S TEMPERATURES
WHEN WAS IT HOTTEST?
LET'S LOOK AT THE GRAPH TO FIND OUT.
LOOK FOR THE HIGHEST POINT.
THE HIGHEST TEMPERATURE WAS ABOUT 28°C. THAT WAS AROUND 1:30 P.M.
28
1:30 PM
ON A LINE GRAPH YOU CAN FIND A MEASUREMENT FOR ANY POINT ON THE BOTTOM LINE.
8:15 AM
8:45 AM
9:15 AM


FRIDAY
EXAMPLE
WHEN WILL MY PLANT BE 8 CM TALL?
THURSDAY
NOTHING YET!
PLANT HEIGHT APR 7
DAY | HEIGHT (CM)
FRI 0 | 0
SAT 1 | 0
SUN 2 | 0
MON 3 | 0
TUES 4 | 0
WED 5 | 0
THURS 6 | 0
FRIDAY
2CM
PLANT HEIGHT APR7
DAY | HEIGHT (CM)
FRI 0 | 0
SAT 1 | 0
SUN 2 | 0
MON 3 | 0
TUES 4 | 0
WED 5 | 0
THURS 6 | 0
FRI 7 | 2
MONDAY
8
9.5
7
MON 10 | 3.5
TUES 11 | 4
WED 12 | 5
THURS 13 | 6
FRI 14 | 7
SAT 15 | —
SUN 16 | —
MON 17 | 9.5
MY PLANT WAS 8 CM TALL ON THE WEEKEND. WHICH DAY DID IT HAPPEN?
TUES 11 | 4
WED 12 | 5
THURS 13 | 6
FRI 14 | 7
SAT 15 | —
SUN 16 | —
MON 17 | 9.5
?
MAKE A LINE GRAPH TO FIND OUT.

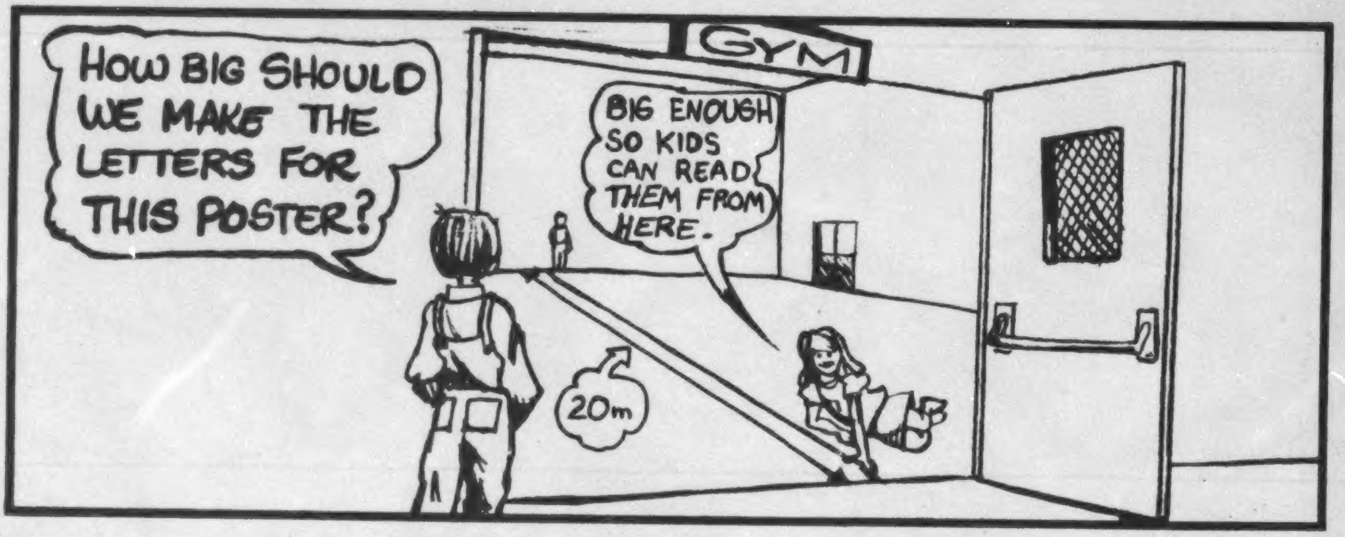

START MARKING YOUR POINTS.
PLANT HEIGHT APR.
DAY
HEIGHT (CM)
FRI 0 — 0
SAT 1 — 0
SUN 2 — 0
MON 3 — 0
TUES 4 — 0
WED 5 — 0
THURS 6 — 0
FRI 7 — 2
HEIGHT (CM)
DAY
FRI 7 — 2
SAT 8 — —
SUN 9 — —
MON 10 — 3.5
TUES 11 — 4
WED 12 — 5
3.5?
PUT THE POINT HALFWAY BETWEEN THE LINE FOR 3 AND THE LINE FOR 4.
3.5
MARK ALL THE POINTS.
HEIGHT (CM)
DAY
DRAW A SMOOTH LINE.
TO FIND OUT WHEN YOUR PLANT WAS 8 CM TALL...
THURS 13 — 6
FRI 14 — 7
SAT 15 — ?
SUN 16
MON 17 — 9.5
GO OVER FROM 8CM...
GROWTH OF MY PLANT
AND DOWN TO THE DAY LINE.
MY PLANT WAS 8 CM TALL ON DAY 15.

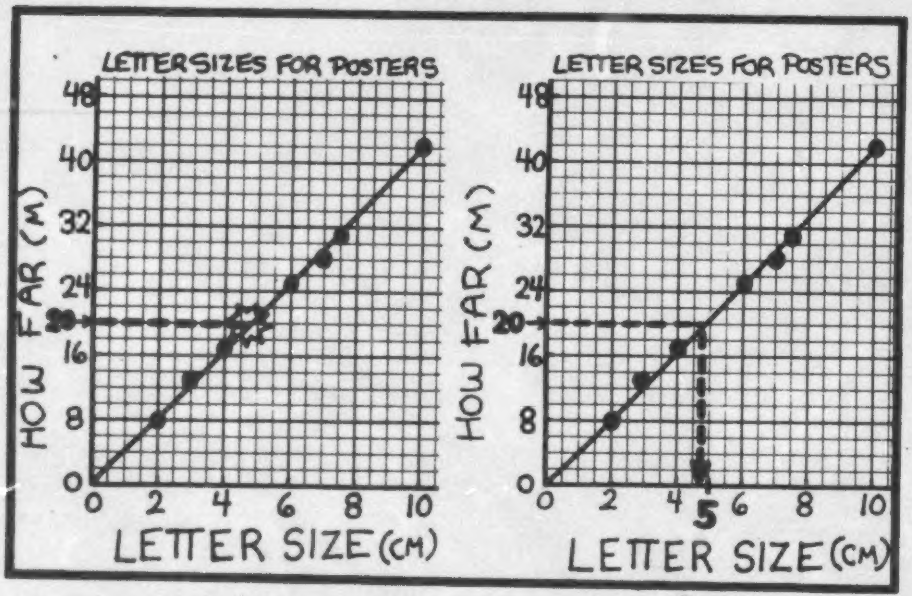

EXAMPLE
ARE THOSE LETTERS BIG ENOUGH?
SALE
S
WHICH IS BETTER?
LET'S MAKE A TEST USING OTHER LETTERS.
SALE
SALE
2CM
EXBF
POSTER LETTERS
DEC.2
LETTER SIZE (cm)
HOW FAR (m)
2
EXBF
?
I CAN'T READ IT.
E,X,B,F.
EXBF
8M.
3CM
ZLST
POSTER LETTERS
DEC.2
LETTER SIZE (cm)
HOW FAR (m)
2
8
ZLST
?
I CAN'T READ IT.
Z,L,S,T.
ZLST
13M.

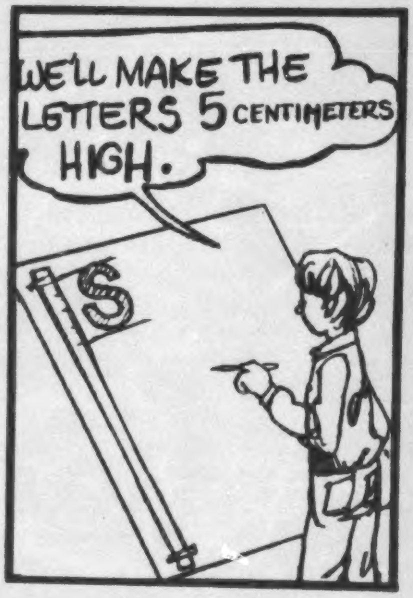

DEC. 2

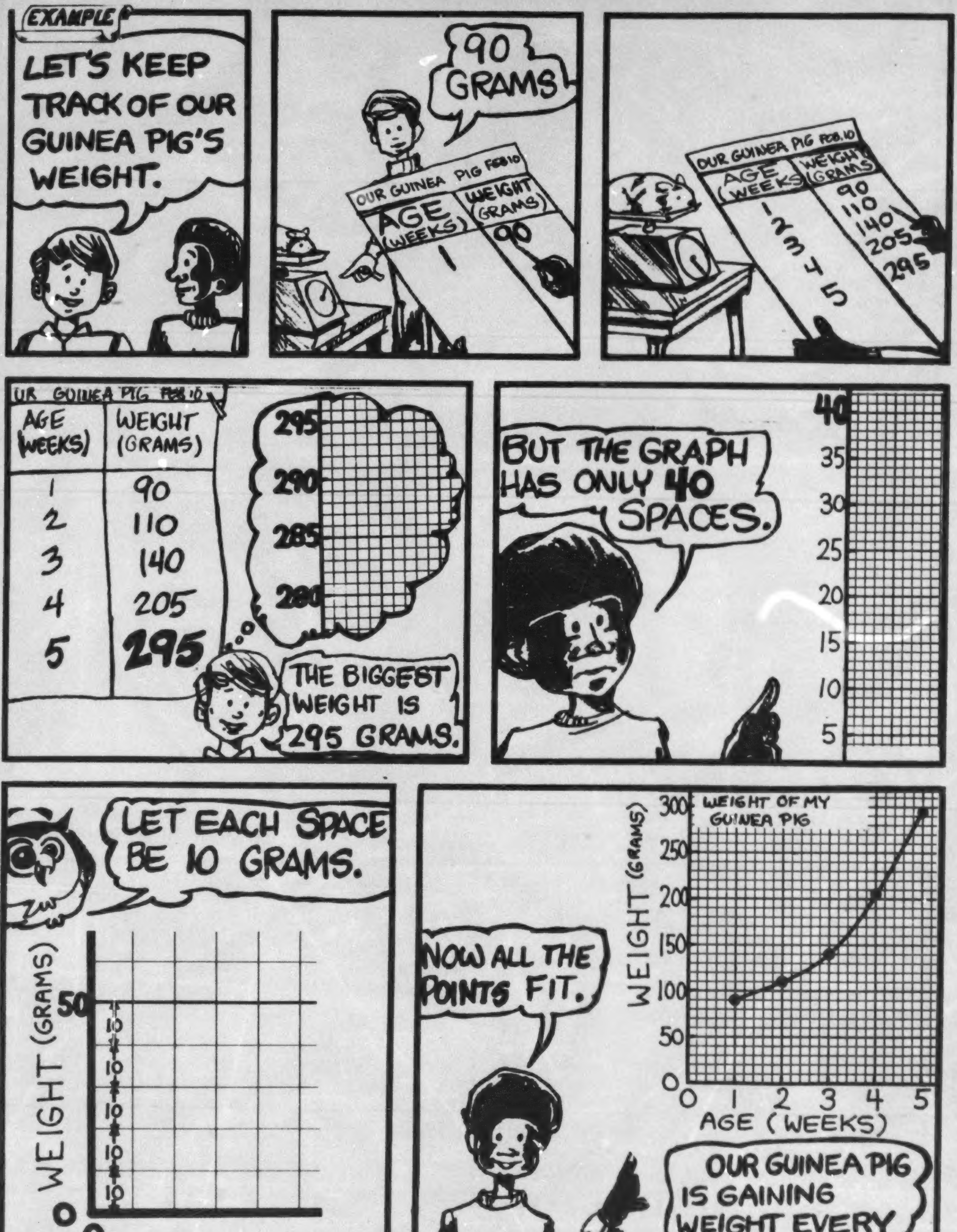
POSTER LETTERS

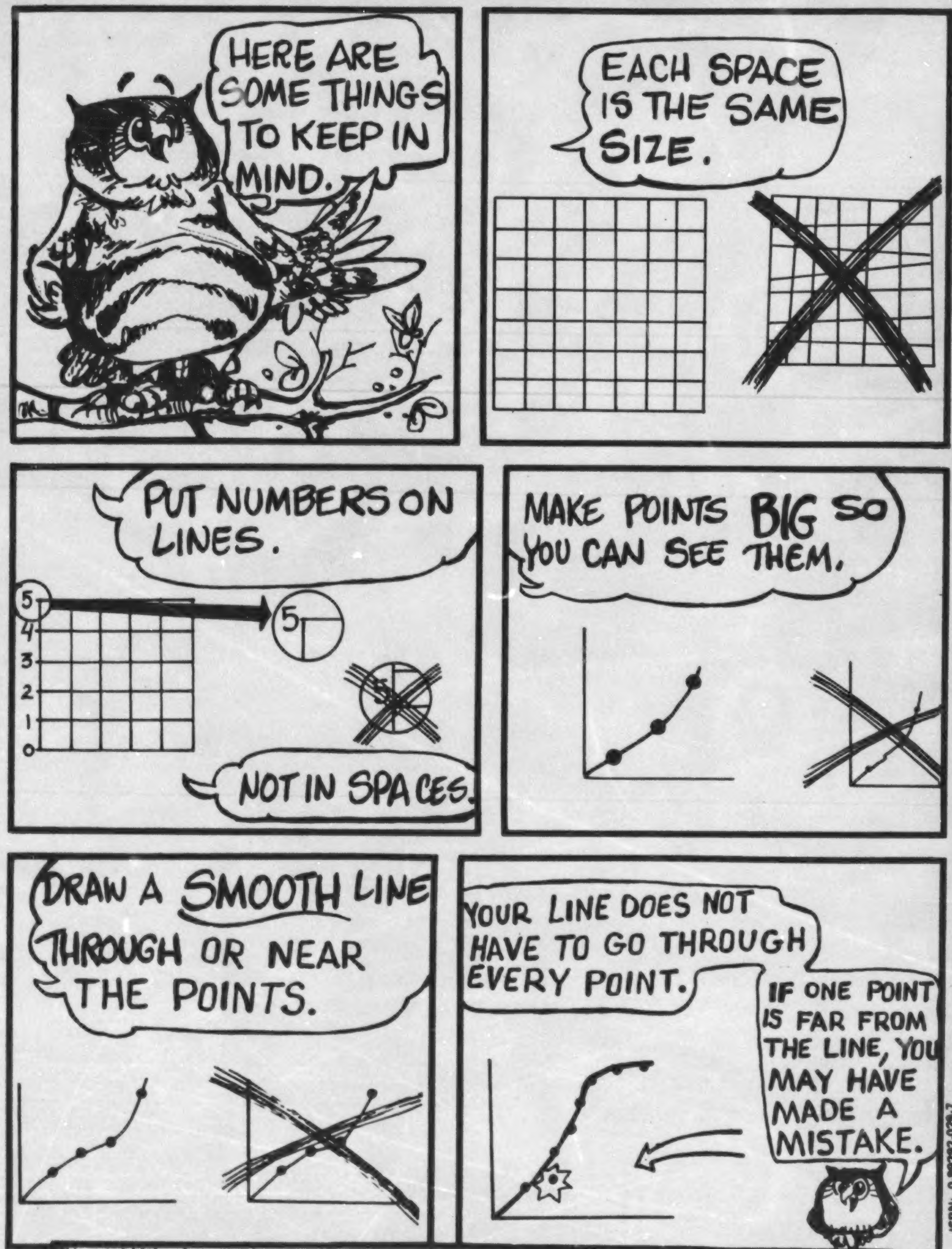
LETTER SIZE (cm)	HOW FAR? (m)
2	8
3	13
4	16.5
6	25
7	28
7.5	31
10	42


HOW BIG SHOULD WE MAKE THE LETTERS FOR THIS POSTER?
GYM
BIG ENOUGH SO KIDS CAN READ THEM FROM HERE.
20m




WE'LL MAKE THE LETTERS 5 CENTIMETERS HIGH.
S


EXAMPLE
LET'S KEEP TRACK OF OUR GUINEA PIG'S WEIGHT.
90 GRAMS
OUR GUINEA PIG FEB.10
AGE (WEEKS)
WEIGHT (GRAMS)
1
90
OUR GUINEA PIG FEB.10
AGE (WEEKS)
WEIGHT (GRAMS)
1 2 3 4 5
90 110 140 205 295
UR GUINEA PIG FEB.10
AGE (WEEKS)
WEIGHT (GRAMS)
1 90
2 110
3 140
4 205
5 295
295
290
285
280
THE BIGGEST WEIGHT IS 295 GRAMS.
BUT THE GRAPH HAS ONLY 40 SPACES.
40
35
30
25
20
15
10
5
LET EACH SPACE BE 10 GRAMS.
WEIGHT (GRAMS)
50
10
10
10
10
10
0
0
NOW ALL THE POINTS FIT.
WEIGHT OF MY GUINEA PIG
WEIGHT (GRAMS)
300
250
200
150
100
50
0
0 1 2 3 4 5
AGE (WEEKS)
OUR GUINEA PIG IS GAINING WEIGHT EVERY WEEK.


HERE ARE SOME THINGS TO KEEP IN MIND.
EACH SPACE IS THE SAME SIZE.
PUT NUMBERS ON LINES.
5
4
3
2
1
0
5
5
NOT IN SPACES.
MAKE POINTS BIG SO YOU CAN SEE THEM.
DRAW A SMOOTH LINE THROUGH OR NEAR THE POINTS.
YOUR LINE DOES NOT HAVE TO GO THROUGH EVERY POINT.
IF ONE POINT IS FAR FROM THE LINE, YOU MAY HAVE MADE A MISTAKE.

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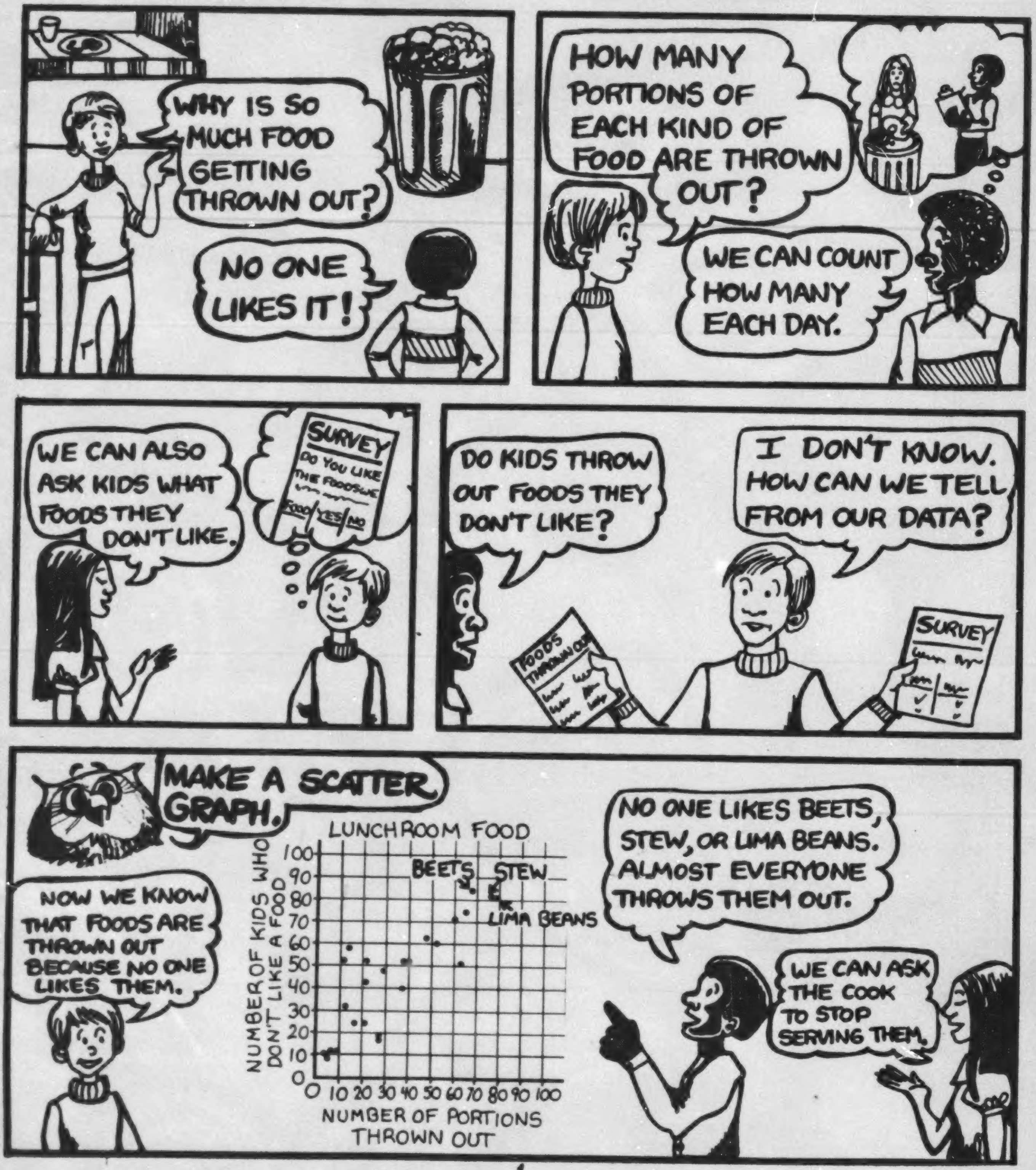
HOW TO

MAKE A SCATTER GRAPH

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS


WHY IS SO MUCH FOOD GETTING THROWN OUT?
NO ONE LIKES IT!
HOW MANY PORTIONS OF EACH KIND OF FOOD ARE THROWN OUT?
WE CAN COUNT HOW MANY EACH DAY.
WE CAN ALSO ASK KIDS WHAT FOODS THEY DON'T LIKE.
SURVEY
DO YOU LIKE THE FOODS WE
FOOD YES NO
DO KIDS THROW OUT FOODS THEY DON'T LIKE?
I DON'T KNOW. HOW CAN WE TELL FROM OUR DATA?
FOODS THROWN OUT
SURVEY
MAKE A SCATTER GRAPH.
NOW WE KNOW THAT FOODS ARE THROWN OUT BECAUSE NO ONE LIKES THEM.
LUNCHROOM FOOD
NUMBER OF KIDS WHO DON'T LIKE A FOOD
0 10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT
0 10 20 30 40 50 60 70 80 90 100
BEETS
STEW
LIMA BEANS
NO ONE LIKES BEETS, STEW, OR LIMA BEANS. ALMOST EVERYONE THROWS THEM OUT.
WE CAN ASK THE COOK TO STOP SERVING THEM.

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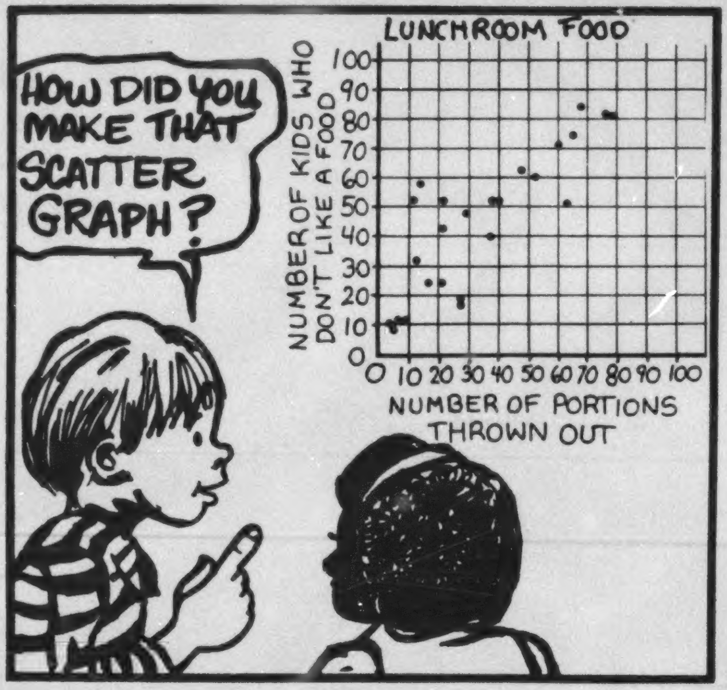
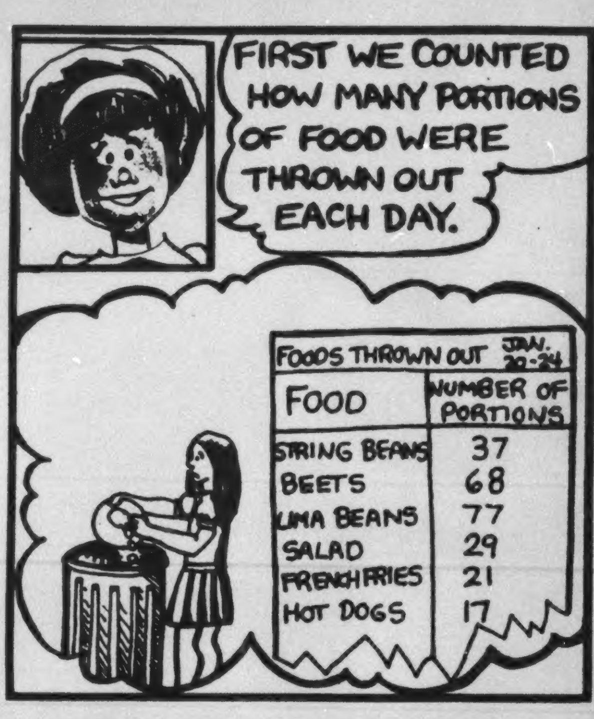
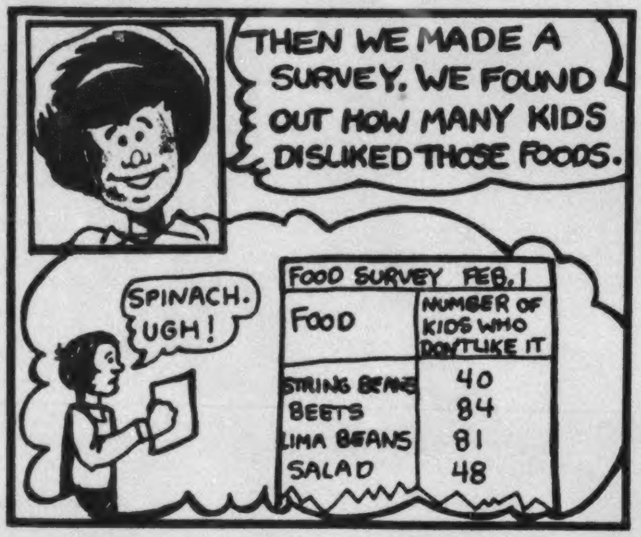
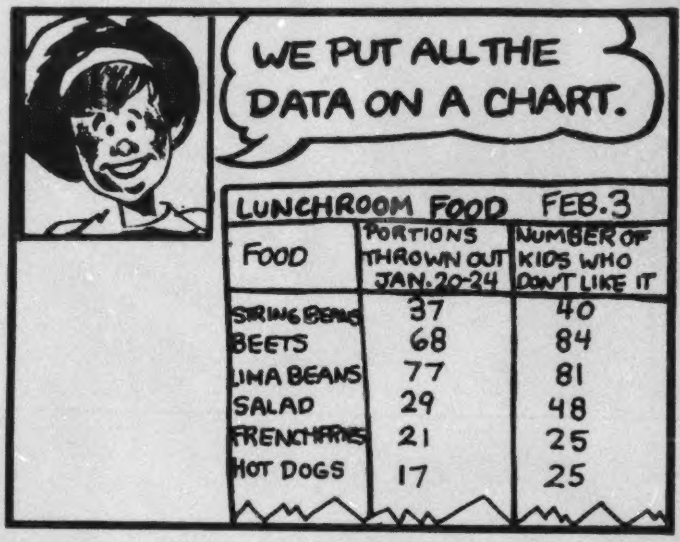

HOW DID YOU MAKE THAT SCATTER GRAPH?
LUNCHROOM FOOD
NUMBER OF KIDS WHO DON'T LIKE A FOOD
0 10 20 30 40 50 60 70 80 90 100
0 10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT


FIRST WE COUNTED HOW MANY PORTIONS OF FOOD WERE THROWN OUT EACH DAY.
FOODS THROWN OUT JAN. 20-24

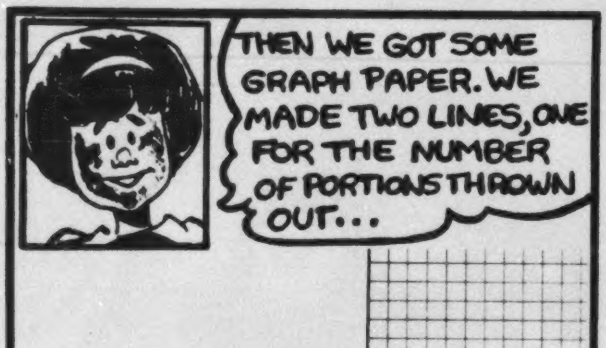
FOOD	NUMBER OF PORTIONS
STRING BEANS	37
BEETS	68
LIMA BEANS	77
SALAD	29
FRENCH FRIES	21
HOT DOGS	17

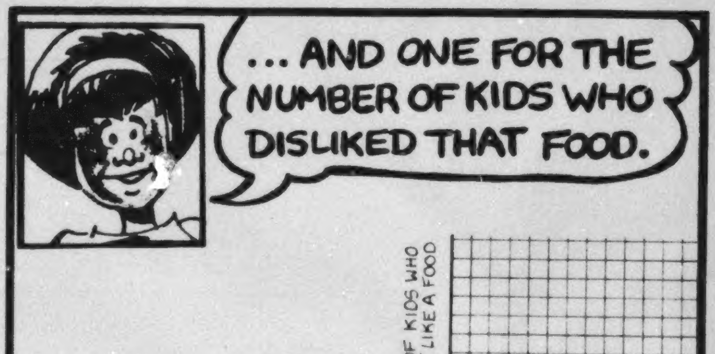

THEN WE MADE A SURVEY. WE FOUND OUT HOW MANY KIDS DISLIKED THOSE FOODS.
SPINACH. UGH!
FOOD SURVEY FEB. 1

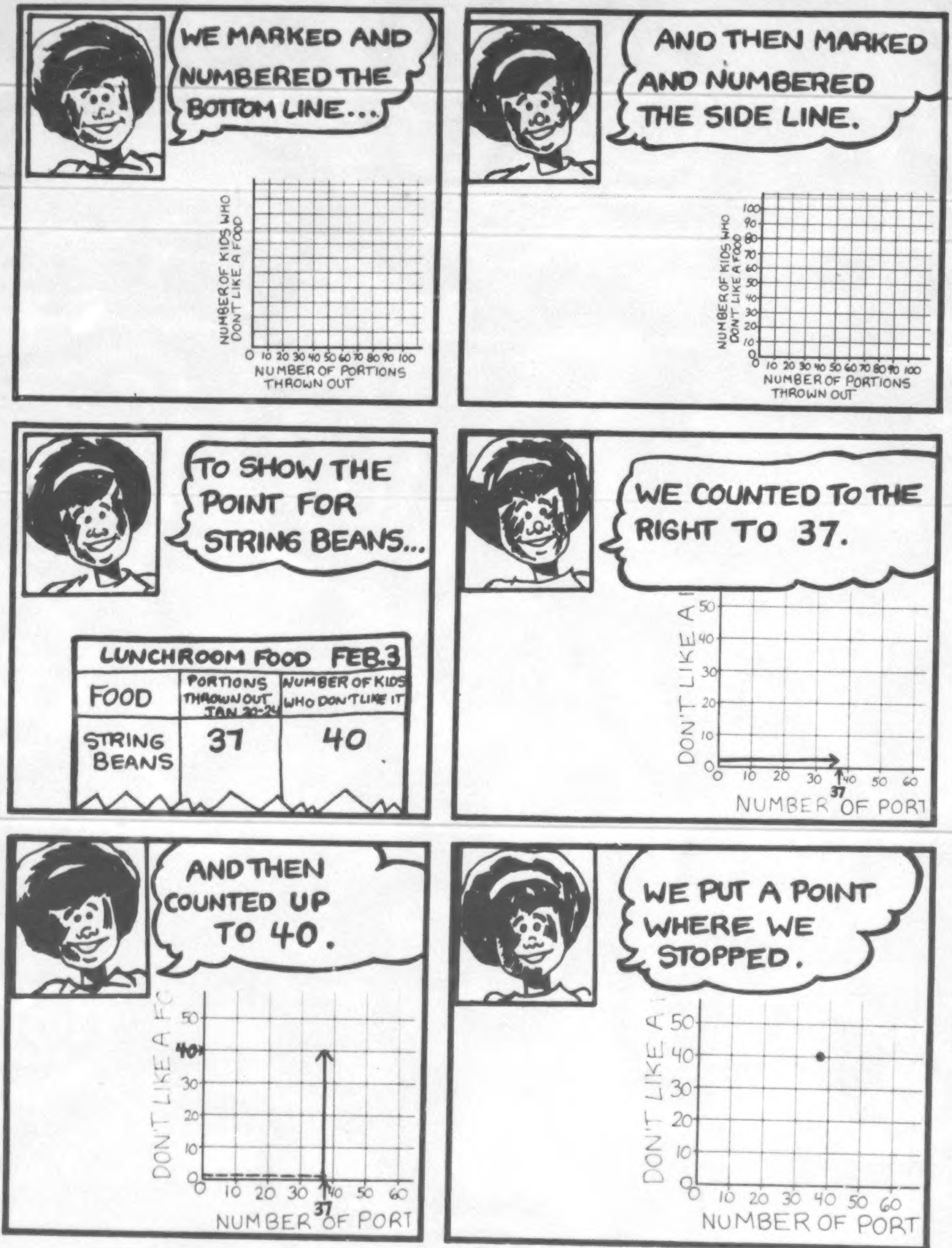
FOOD	NUMBER OF KIDS WHO DON'T LIKE IT
STRING BEANS	40
BEETS	84
LIMA BEANS	81
SALAD	48


WE PUT ALL THE DATA ON A CHART.
LUNCHROOM FOOD FEB. 3

FOOD	PORTIONS THROWN OUT JAN. 20-24	NUMBER OF KIDS WHO DON'T LIKE IT
STRING BEANS	37	40
BEETS	68	84
LIMA BEANS	77	81
SALAD	29	48
FRENCH FRIES	21	25
HOT DOGS	17	25

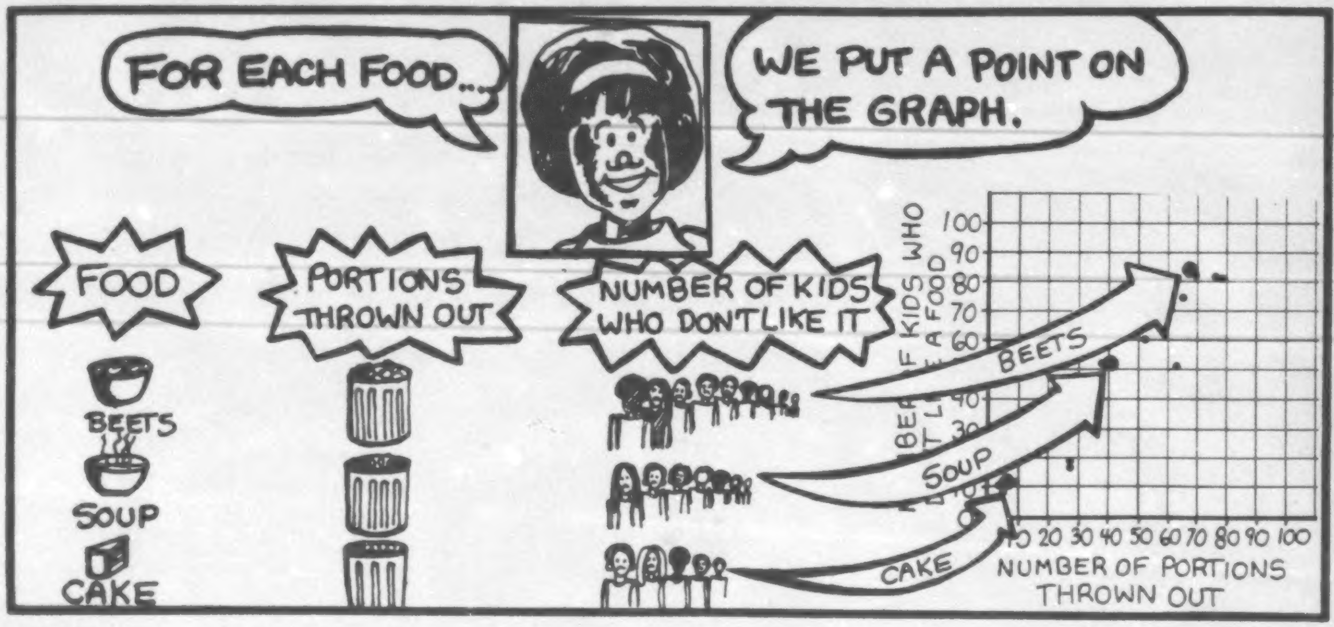

THEN WE GOT SOME GRAPH PAPER. WE MADE TWO LINES, ONE FOR THE NUMBER OF PORTIONS THROWN OUT...
NUMBER OF PORTIONS THROWN OUT

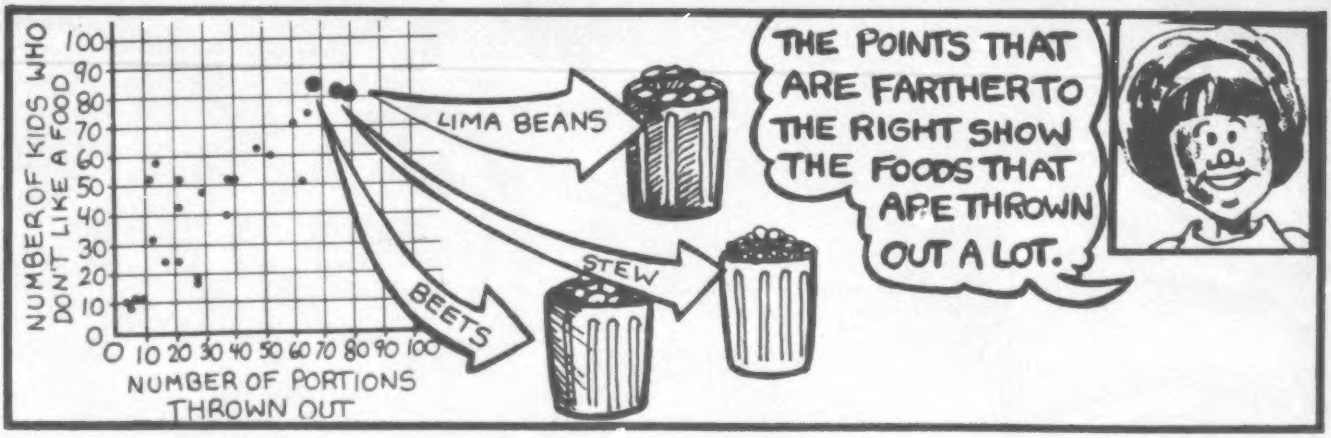

... AND ONE FOR THE NUMBER OF KIDS WHO DISLIKED THAT FOOD.
NUMBER OF KIDS WHO DON'T LIKE A FOOD
NUMBER OF PORTIONS THROWN OUT

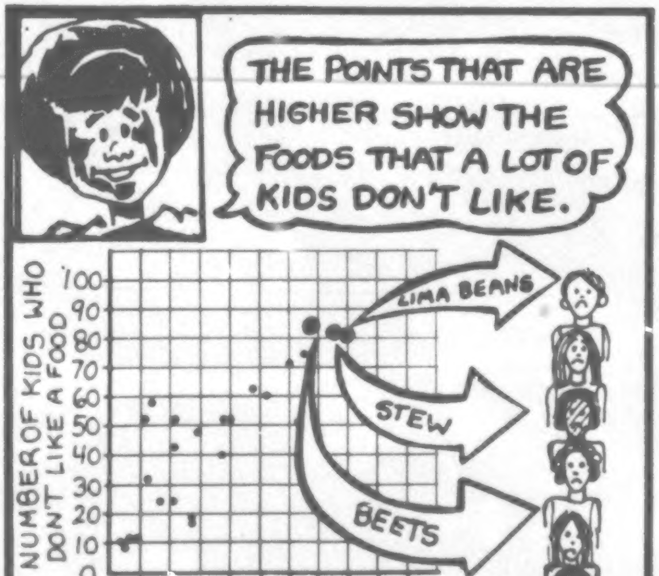

WE MARKED AND NUMBERED THE BOTTOM LINE...
NUMBER OF KIDS WHO DON'T LIKE A FOOD
0 10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT
AND THEN MARKED AND NUMBERED THE SIDE LINE.
NUMBER OF KIDS WHO DON'T LIKE A FOOD
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT
TO SHOW THE POINT FOR STRING BEANS...
WE COUNTED TO THE RIGHT TO 37.
DON'T LIKE A
50 40 30 20 10 0
0 10 20 30 40 50 60
37
NUMBER OF PORT
AND THEN COUNTED UP TO 40.
DON'T LIKE A FC
50 40 30 20 10 0
0 10 20 30 40 50 60
37
NUMBER OF PORT
WE PUT A POINT WHERE WE STOPPED.
DON'T LIKE A
50 40 30 20 10 0
0 10 20 30 40 50 60
NUMBER OF PORT

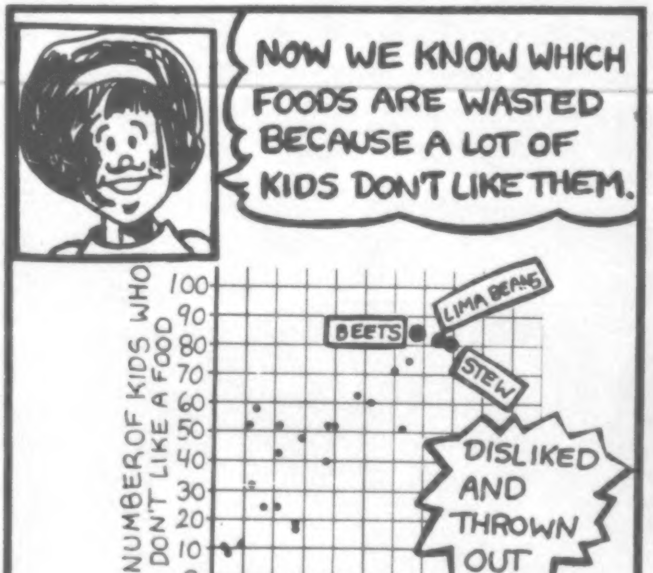
LUNCHROOM FOOD FEB.3

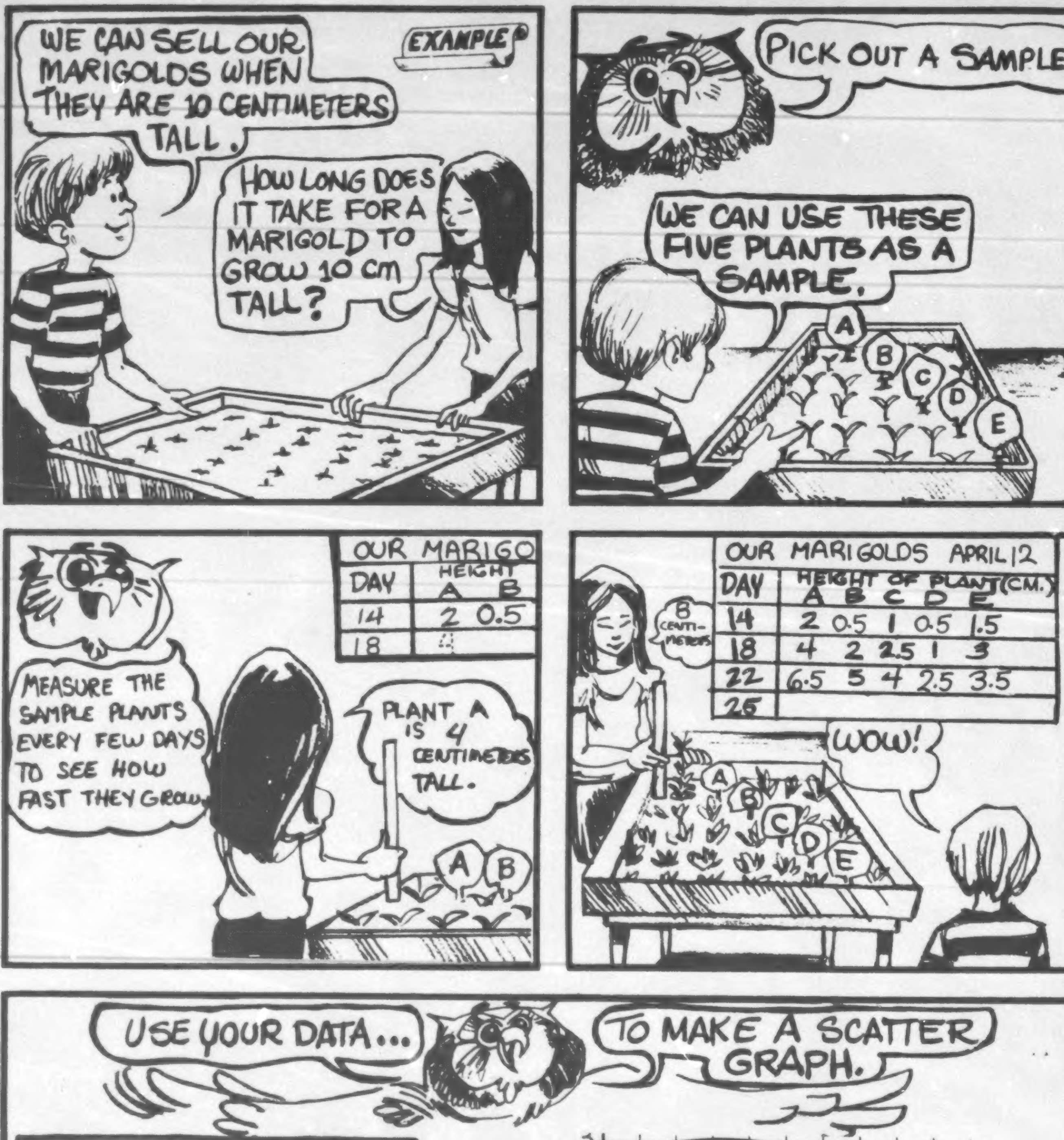
FOOD	PORTIONS THROWN OUT JAN 20-24	NUMBER OF KIDS WHO DON'T LIKE IT
STRING BEANS	37	40

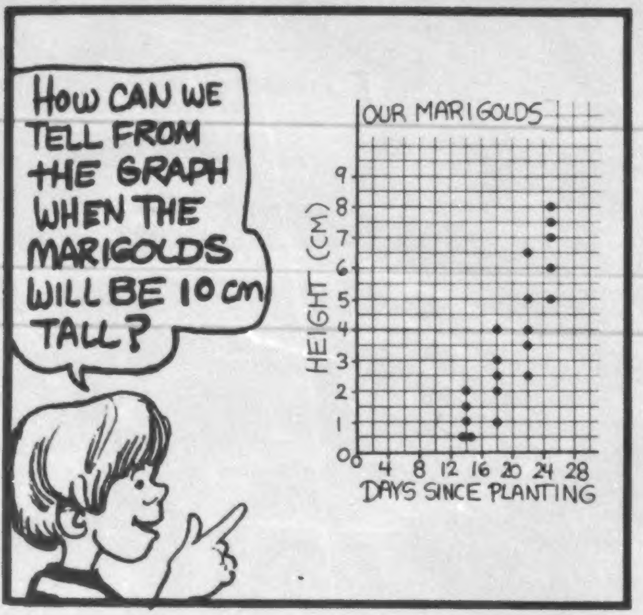

FOR EACH FOOD...
WE PUT A POINT ON THE GRAPH.
FOOD
PORTIONS THROWN OUT
NUMBER OF KIDS WHO DON'T LIKE IT
BEETS
SOUP
CAKE
BEETS
SOUP
CAKE
NUMBER OF KIDS WHO DON'T LIKE A FOOD
100 90 80 70 60 50 40 30 20 10
10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT

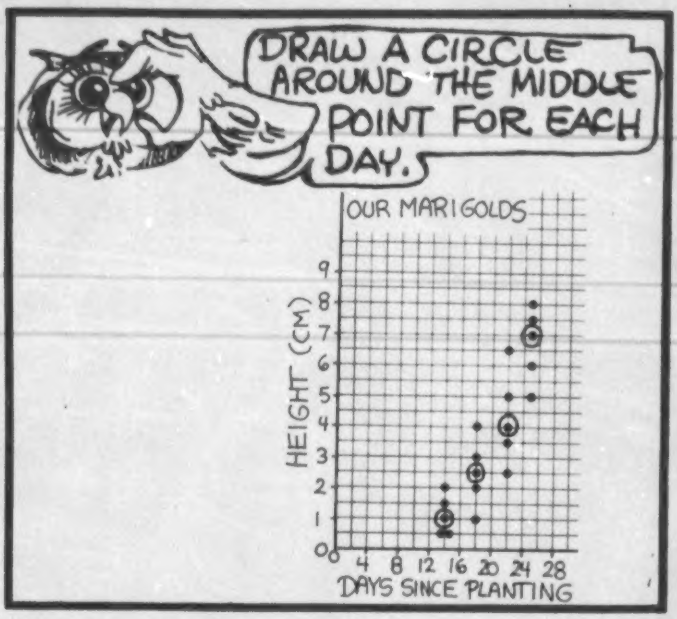

NUMBER OF KIDS WHO DON'T LIKE A FOOD
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT
LIMA BEANS
STEW
BEETS
THE POINTS THAT ARE FARTHER TO THE RIGHT SHOW THE FOODS THAT ARE THROWN OUT A LOT.

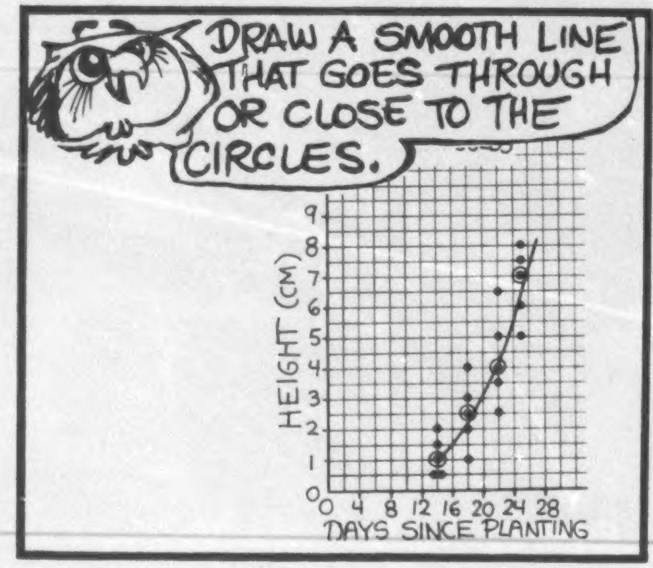

THE POINTS THAT ARE HIGHER SHOW THE FOODS THAT A LOT OF KIDS DON'T LIKE.
NUMBER OF KIDS WHO DON'T LIKE A FOOD
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT
LIMA BEANS
STEW
BEETS

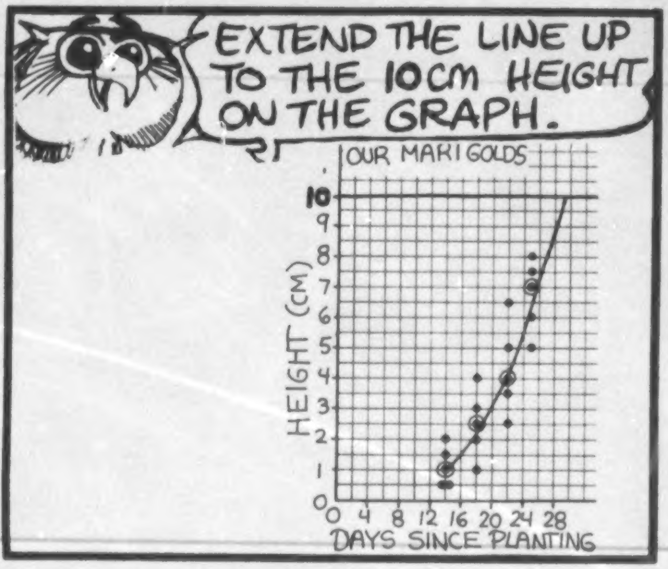

NOW WE KNOW WHICH FOODS ARE WASTED BECAUSE A LOT OF KIDS DON'T LIKE THEM.
NUMBER OF KIDS WHO DON'T LIKE A FOOD
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NUMBER OF PORTIONS THROWN OUT
BEETS
LIMA BEANS
STEW
DISLIKED AND THROWN OUT

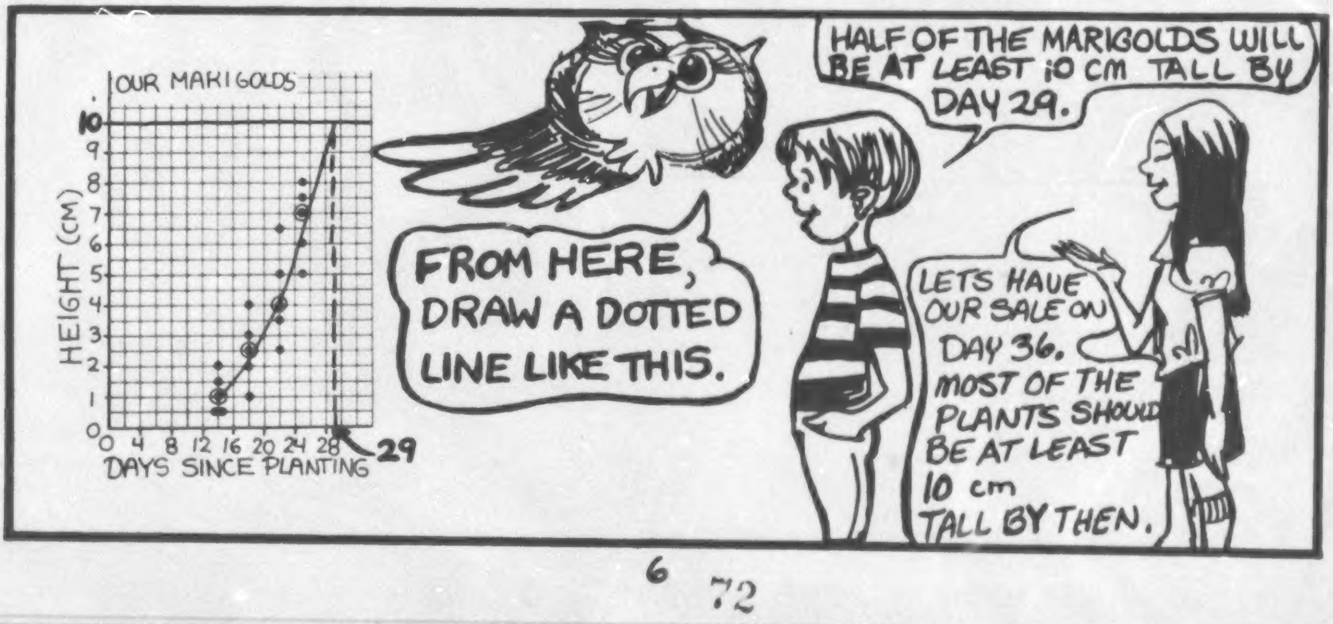

EXAMPLE
WE CAN SELL OUR MARIGOLDS WHEN THEY ARE 10 CENTIMETERS TALL.
HOW LONG DOES IT TAKE FOR A MARIGOLD TO GROW 10 CM TALL?
PICK OUT A SAMPLE.
WE CAN USE THESE FIVE PLANTS AS A SAMPLE.
A
B
C
D
E
OUR MARIGO
DAY
HEIGHT
A B
14 2 0.5
18 4
MEASURE THE SAMPLE PLANTS EVERY FEW DAYS TO SEE HOW FAST THEY GROW
PLANT A IS 4 CENTIMETERS TALL.
A
B
OUR MARIGOLDS APRIL 12
DAY HEIGHT OF PLANT (CM.)
A B C D E
14 2 0.5 1 0.5 1.5
18 4 2 2.5 1 3
22 6.5 5 4 2.5 3.5
25
8 CENTIMETERS
WOW!
A
B
C
D
E
USE YOUR DATA...
TO MAKE A SCATTER GRAPH.
OUR MARIGOLDS APRIL 12
DAY HEIGHT OF PLANTS (CM)
A B C D E
14 2 0.5 1 0.5 1.5
18 4 2 2.5 1 3
22 6.5 5 4 2.5 3.5
25 8 7.5 6 5 7
HEIGHT (CM)
1
1.5
2
3
0
4
8
12
14
16
20
DAYS SINCE PLANTING

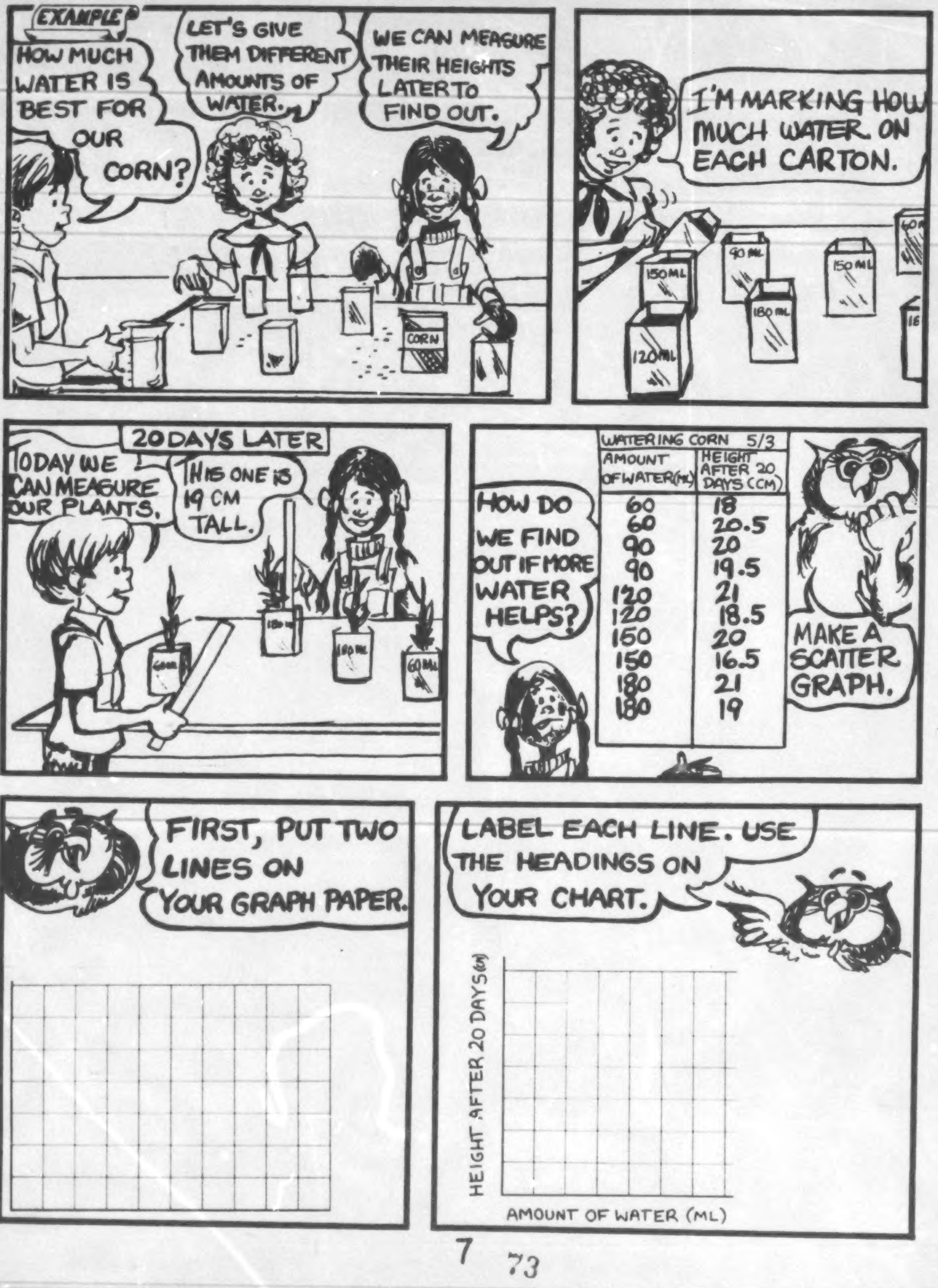

HOW CAN WE TELL FROM THE GRAPH WHEN THE MARIGOLDS WILL BE 10 cm TALL?
OUR MARIGOLDS
HEIGHT (CM)
0 1 2 3 4 5 6 7 8 9
0 4 8 12 16 20 24 28
DAYS SINCE PLANTING


DRAW A CIRCLE AROUND THE MIDDLE POINT FOR EACH DAY.
OUR MARIGOLDS
HEIGHT (CM)
0 1 2 3 4 5 6 7 8 9
0 4 8 12 16 20 24 28
DAYS SINCE PLANTING


DRAW A SMOOTH LINE THAT GOES THROUGH OR CLOSE TO THE CIRCLES.
HEIGHT (CM)
0 1 2 3 4 5 6 7 8 9
0 4 8 12 16 20 24 28
DAYS SINCE PLANTING

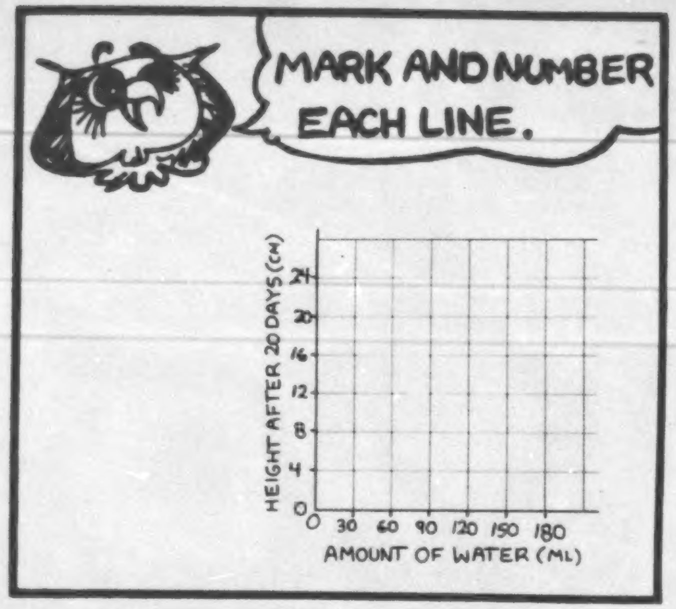

EXTEND THE LINE UP TO THE 10 CM HEIGHT ON THE GRAPH.
OUR MARIGOLDS
HEIGHT (CM)
0 1 2 3 4 5 6 7 8 9 10
0 4 8 12 16 20 24 28
DAYS SINCE PLANTING

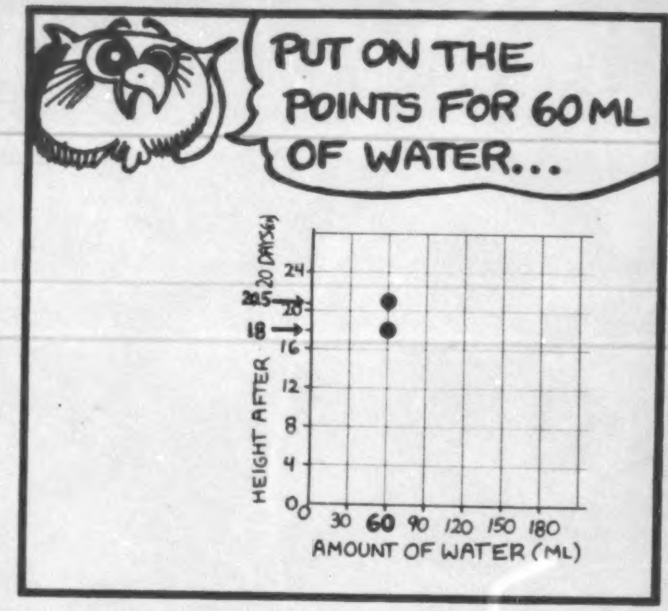

OUR MARIGOLDS
HEIGHT (CM)
0 1 2 3 4 5 6 7 8 9 10
0 4 8 12 16 20 24 28
DAYS SINCE PLANTING
29
FROM HERE, DRAW A DOTTED LINE LIKE THIS.
HALF OF THE MARIGOLDS WILL BE AT LEAST 10 CM TALL BY DAY 29.
LETS HAVE OUR SALE ON DAY 36. MOST OF THE PLANTS SHOULD BE AT LEAST 10 cm TALL BY THEN.

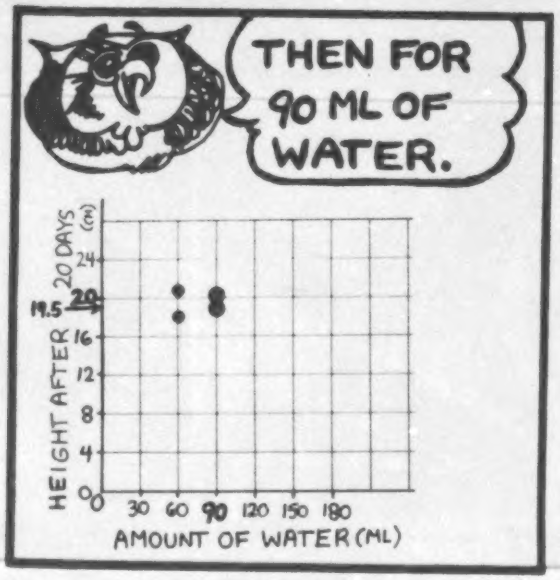

EXAMPLE
HOW MUCH WATER IS BEST FOR OUR CORN?
LET'S GIVE THEM DIFFERENT AMOUNTS OF WATER.
WE CAN MEASURE THEIR HEIGHTS LATER TO FIND OUT.
CORN
I'M MARKING HOW MUCH WATER ON EACH CARTON.
150ML
90 ML
150 ML
180 ML
120ML
20 DAYS LATER
TODAY WE CAN MEASURE OUR PLANTS.
THIS ONE IS 19 CM TALL.
60ML
HOW DO WE FIND OUT IF MORE WATER HELPS?
MAKE A SCATTER GRAPH.
FIRST, PUT TWO LINES ON YOUR GRAPH PAPER.
LABEL EACH LINE. USE THE HEADINGS ON YOUR CHART.
HEIGHT AFTER 20 DAYS (CM)
AMOUNT OF WATER (ML)

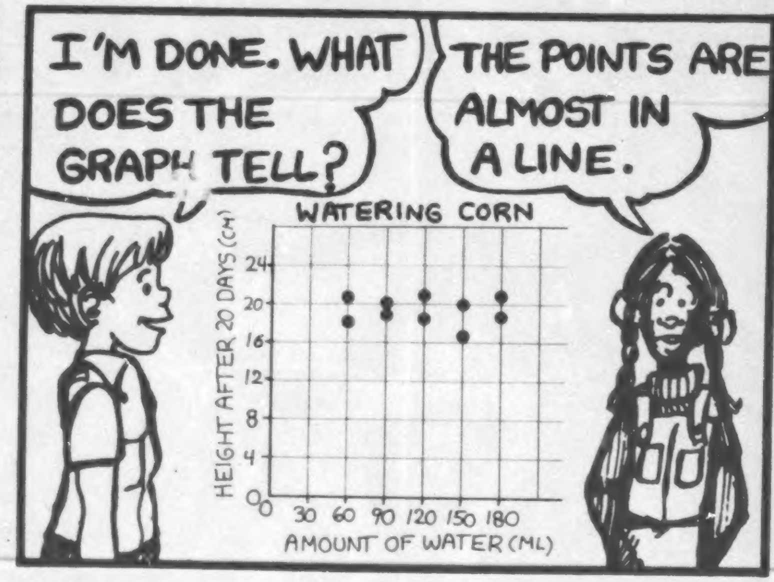
WATERING CORN 5/3

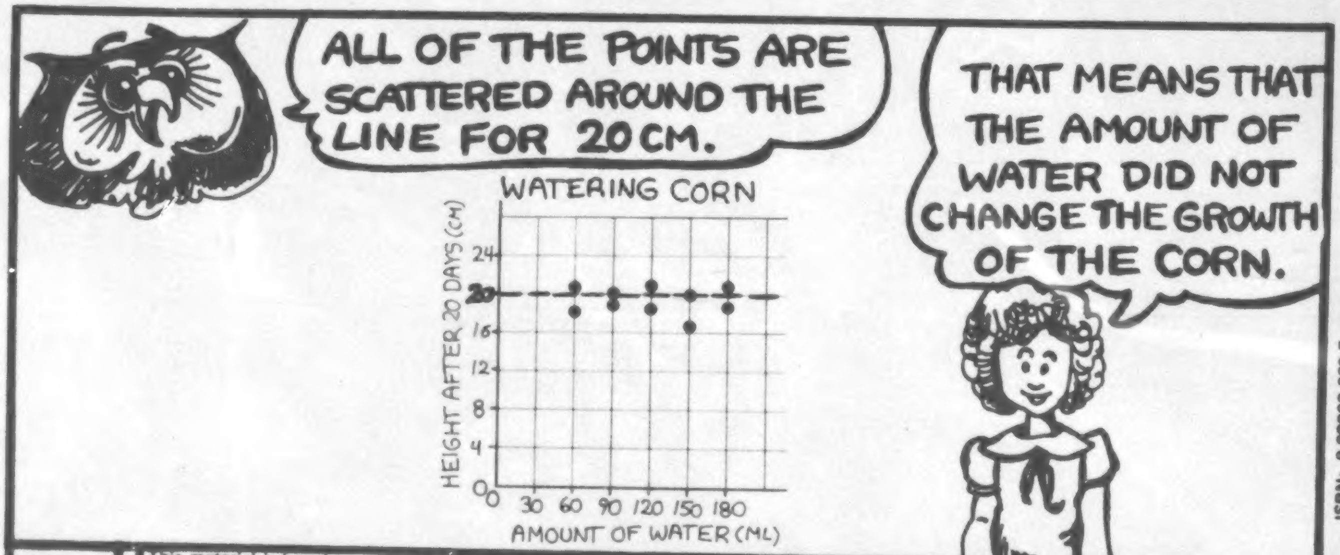
AMOUNT OF WATER (ML)	HEIGHT AFTER 20 DAYS (CM)
60	18
60	20.5
90	20
90	19.5
120	21
120	18.5
150	20
150	16.5
180	21
180	19


MARK AND NUMBER EACH LINE.
HEIGHT AFTER 20 DAYS (CM)
24
20
16
12
8
4
0
0
30
60
90
120
150
180
AMOUNT OF WATER (ML)


PUT ON THE POINTS FOR 60 ML OF WATER...
HEIGHT AFTER 20 DAYS (CM)
20.5
18
24
20
16
12
8
4
0
0
30
60
90
120
150
180
AMOUNT OF WATER (ML)


THEN FOR 90 ML OF WATER.
HEIGHT AFTER 20 DAYS (CM)
19.5
24
20
16
12
8
4
0
0
30
60
90
120
150
180
AMOUNT OF WATER (ML)


I'M DONE. WHAT DOES THE GRAPH TELL?
THE POINTS ARE ALMOST IN A LINE.
WATERING CORN
HEIGHT AFTER 20 DAYS (CM)
24
20
16
12
8
4
0
0
30
60
90
120
150
180
AMOUNT OF WATER (ML)


ALL OF THE POINTS ARE SCATTERED AROUND THE LINE FOR 20 CM.
THAT MEANS THAT THE AMOUNT OF WATER DID NOT CHANGE THE GROWTH OF THE CORN.
WATERING CORN
HEIGHT AFTER 20 DAYS (CM)
24
20
16
12
8
4
0
0
30
60
90
120
150
180
AMOUNT OF WATER (ML)

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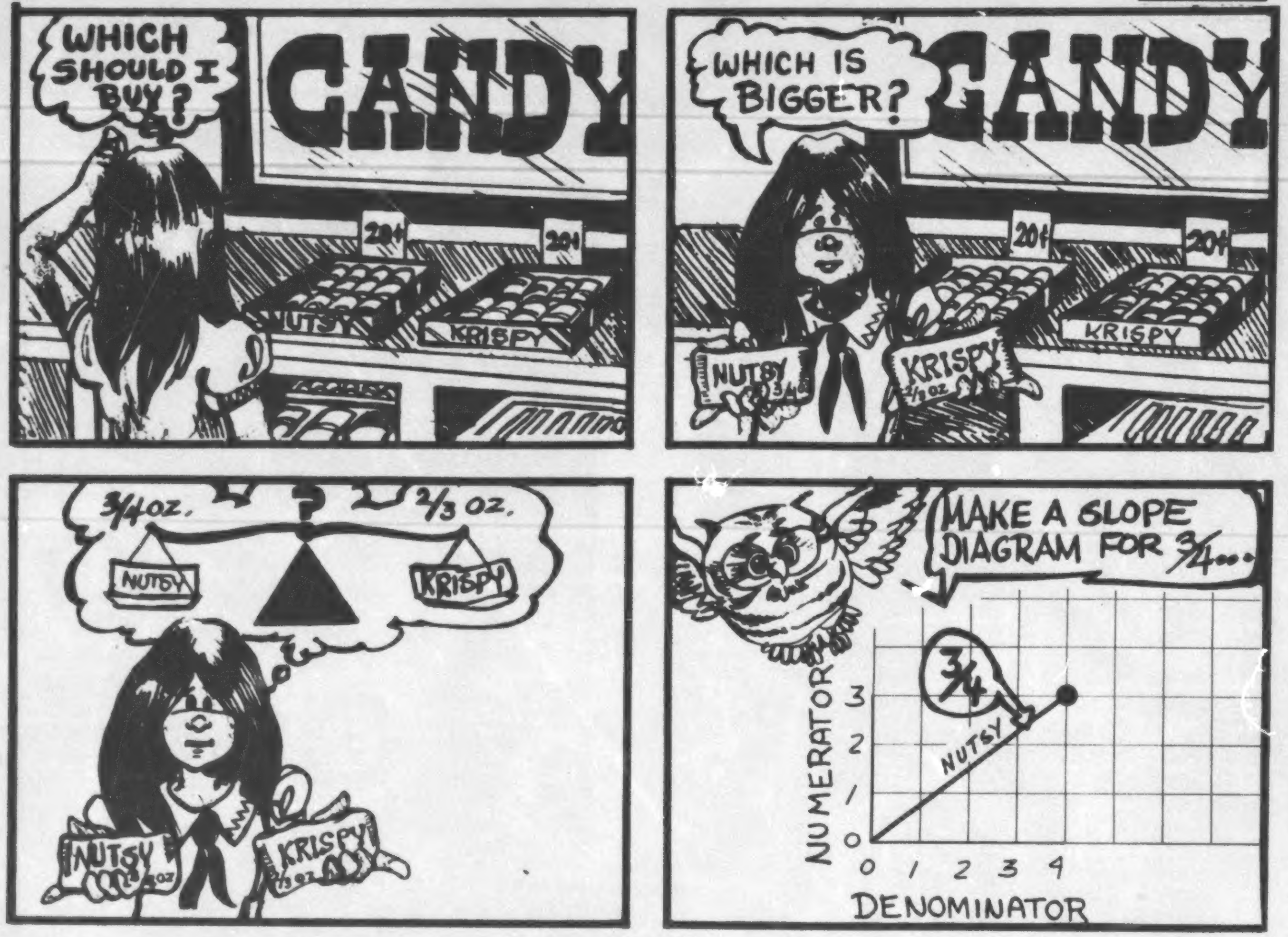
HOW TO
MAKE A SLOPE DIAGRAM

USMES
UNIFIED SCIENCES AND MATHEMATICS FOR ELEMENTARY SCHOOLS


WHICH SHOULD I BUY?
CANDY
20¢
20¢
NUTSY
KRISPY
WHICH IS BIGGER?
CANDY
20¢
20¢
KRISPY
NUTSY 3/4 oz
KRISPY 2/3 oz
3/4 oz.
?
2/3 oz.
NUTSY
KRISPY
NUTSY 3/4 oz
KRISPY 2/3 oz
MAKE A SLOPE DIAGRAM FOR 3/4...
3/4
NUTSY
NUMERATOR
0 1 2 3
0 1 2 3 4
DENOMINATOR
...AND 2/3.
3/4
2/3
NUTSY
KRISPY
NUMERATOR
0 1 2 3 4 5
0 1 2 3 4 5 6
DENOMINATOR
THE NUTSY LINE IS STEEPER, SO NUTSY WEIGHS MORE.
NUTSY

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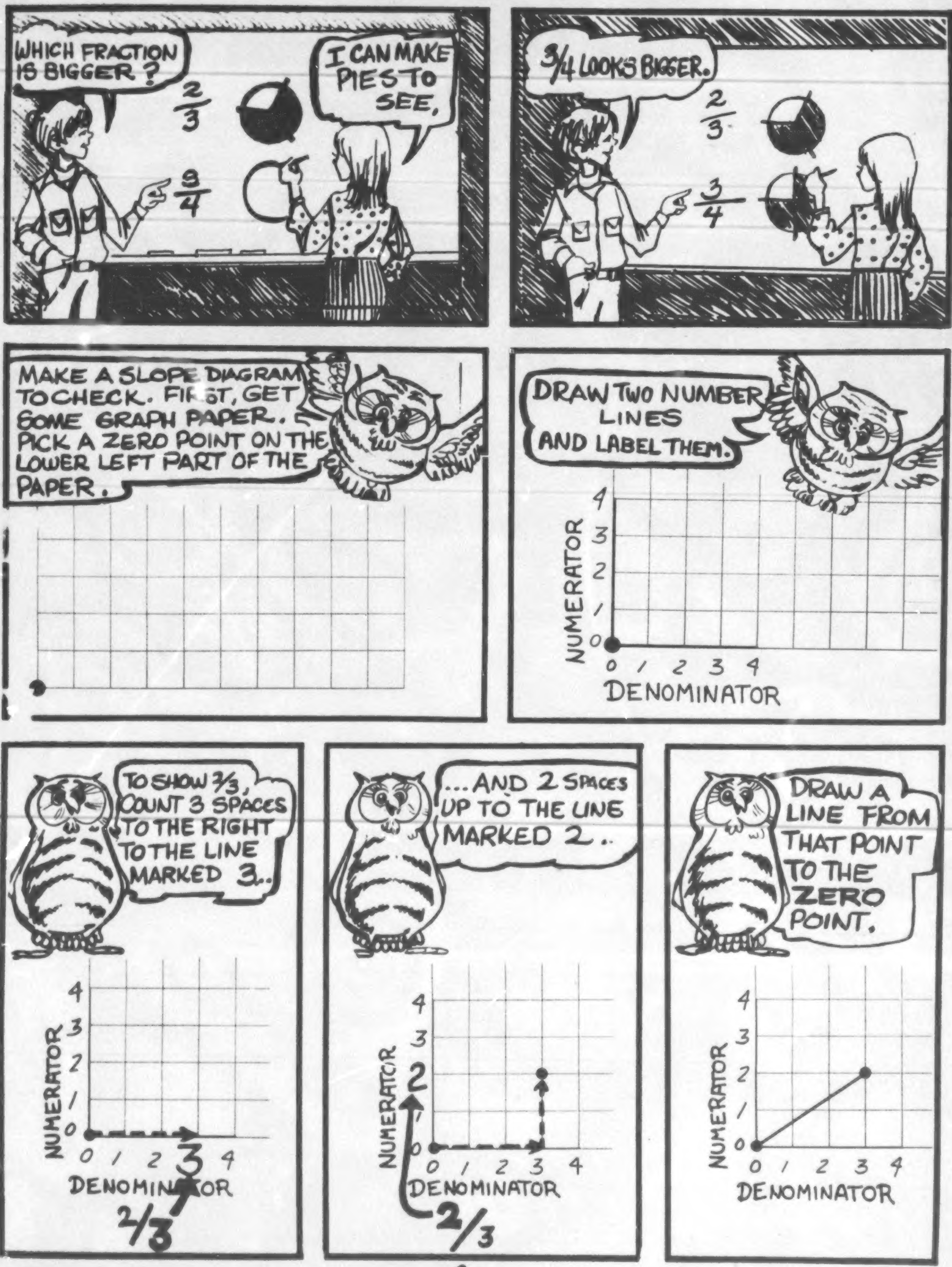
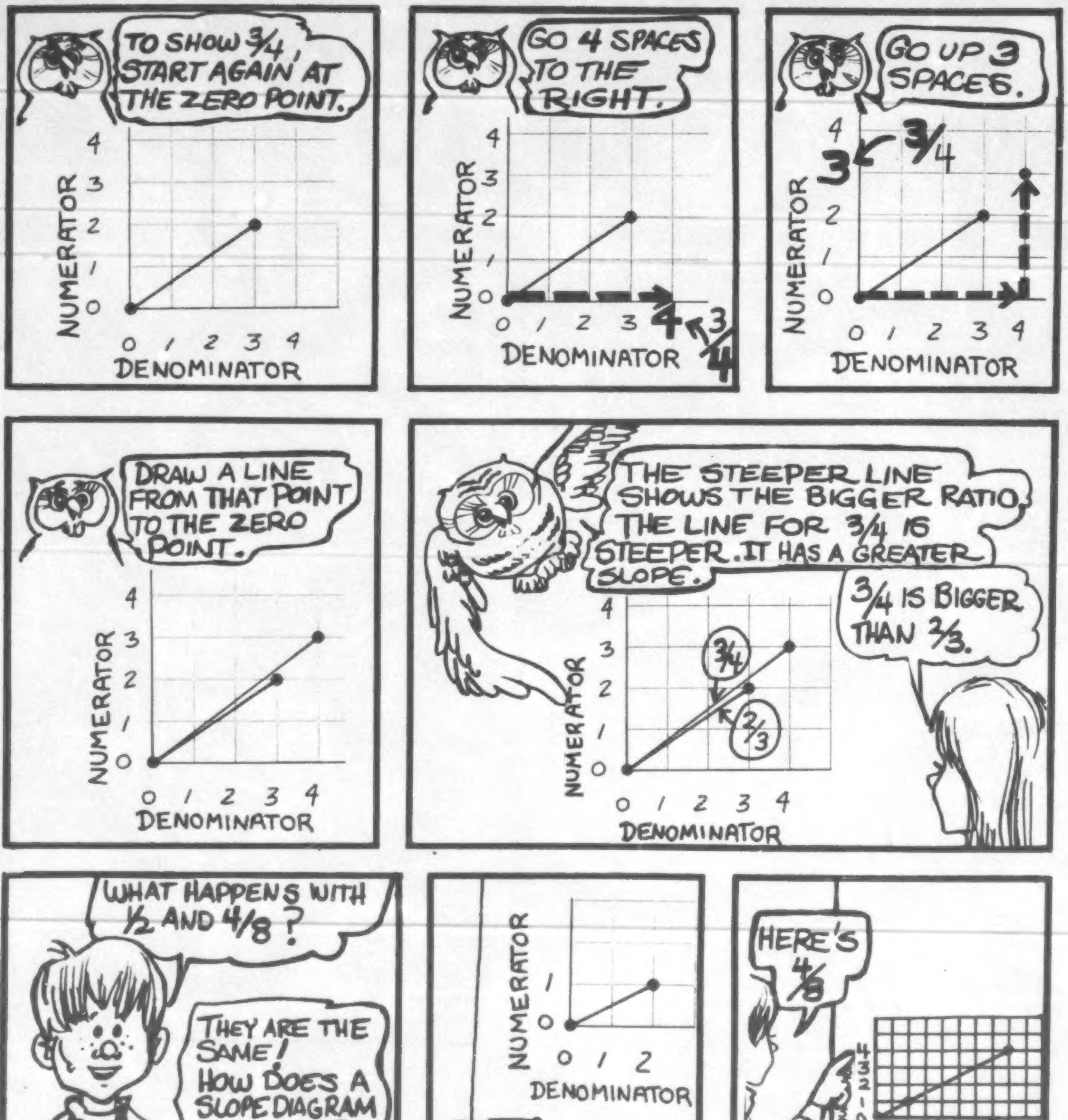
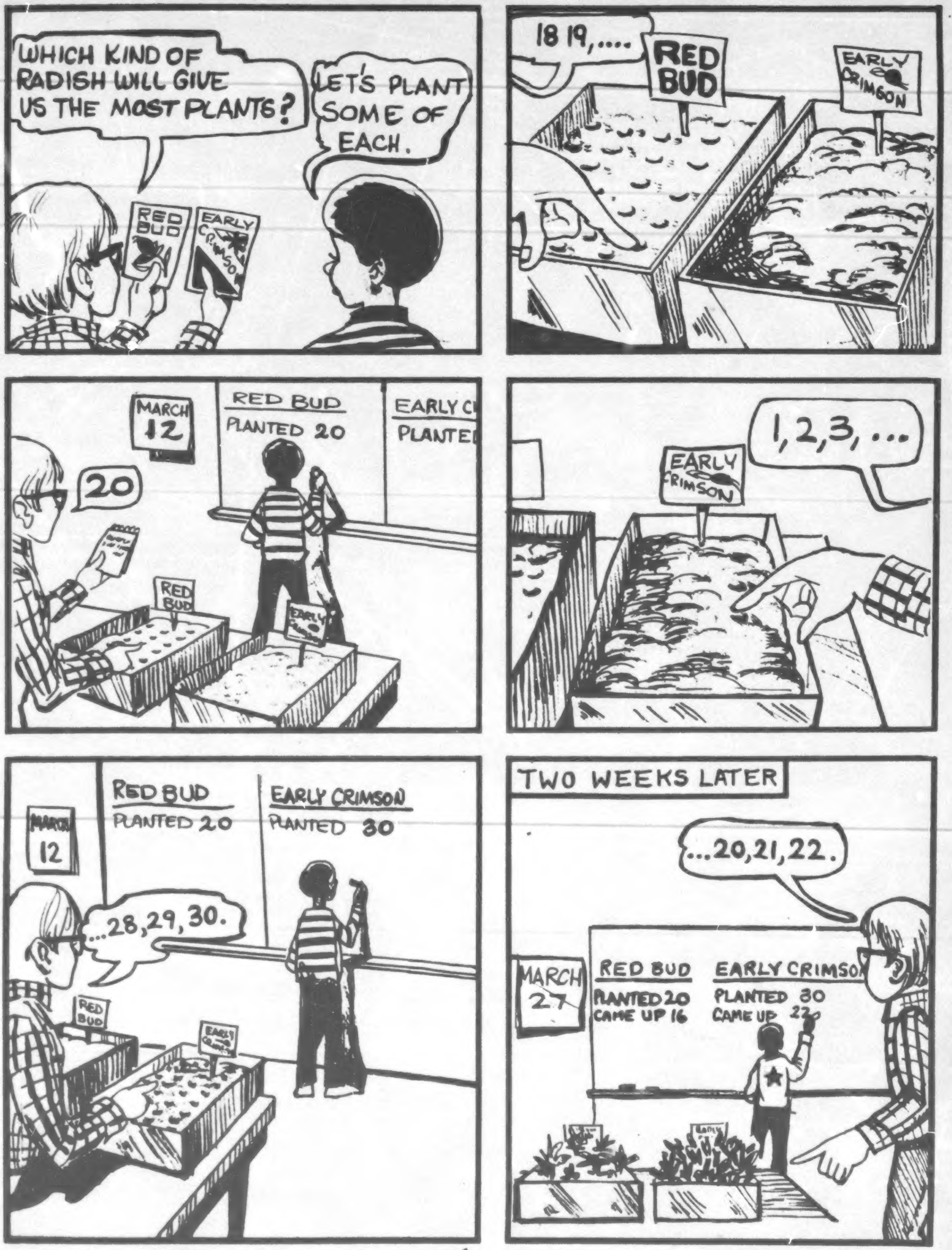
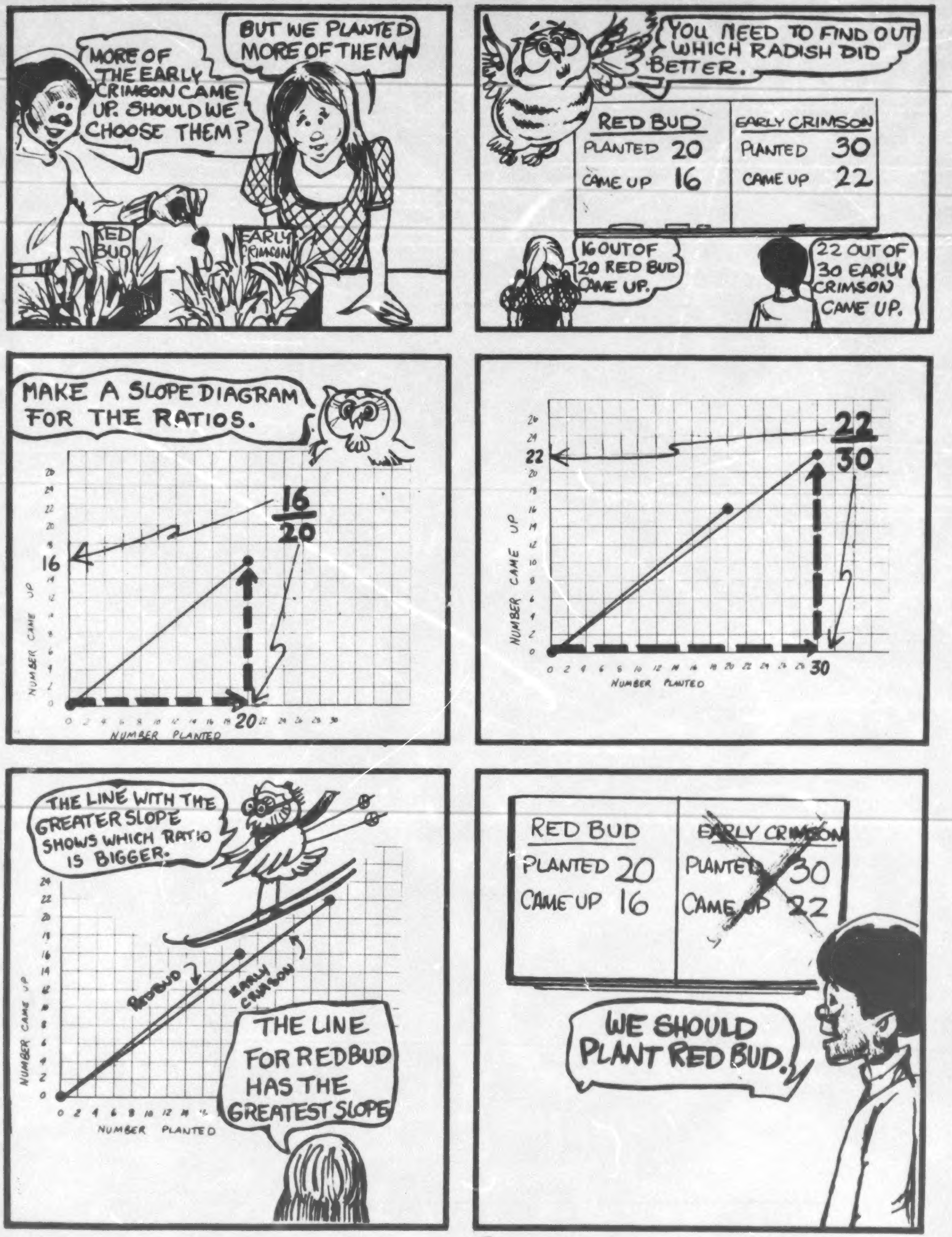
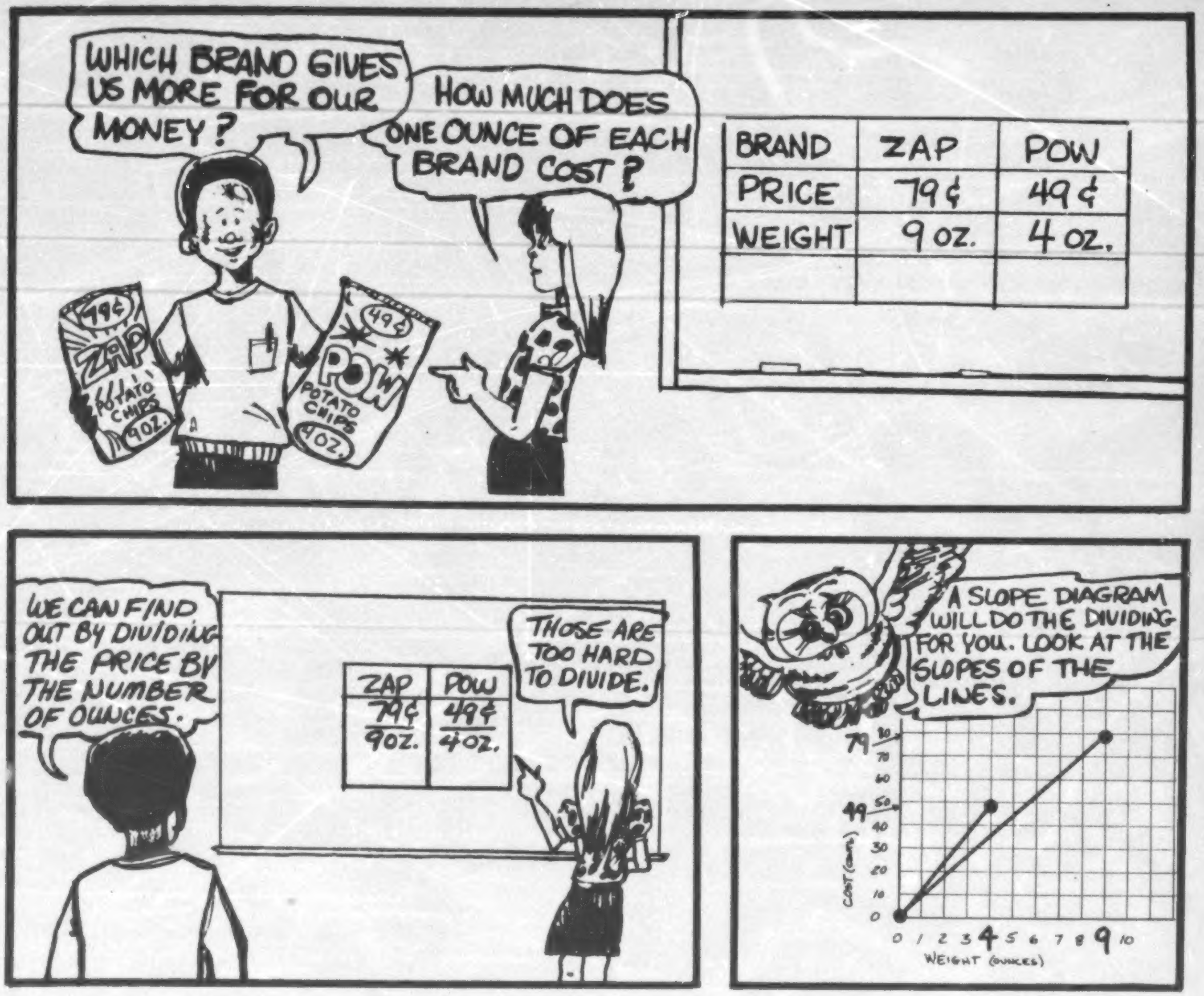
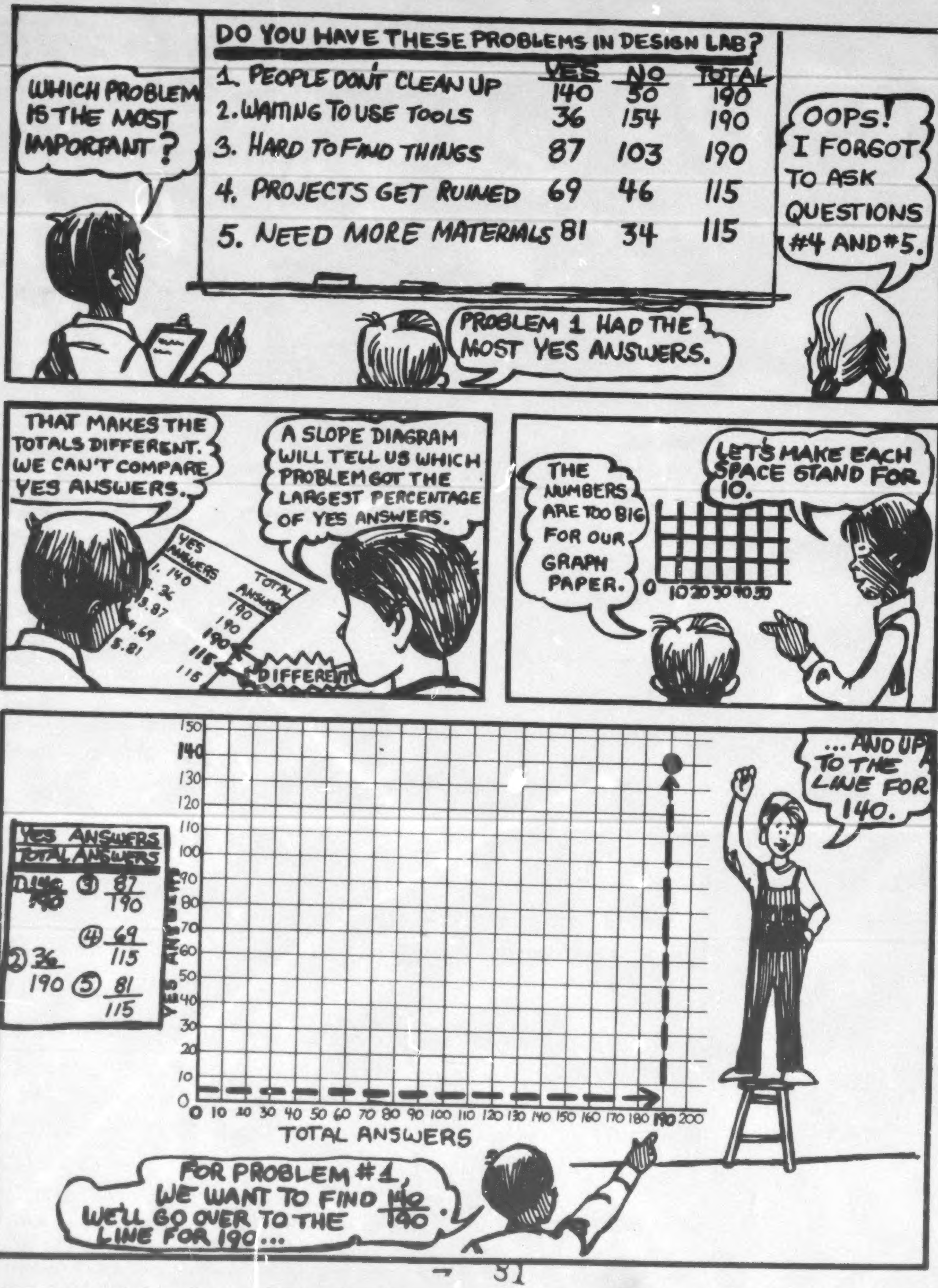

WHICH FRACTION IS BIGGER ?
2/3
3/4
I CAN MAKE PIES TO SEE,
3/4 LOOKS BIGGER.
2/3
3/4
MAKE A SLOPE DIAGRAM TO CHECK. FIRST, GET SOME GRAPH PAPER. PICK A ZERO POINT ON THE LOWER LEFT PART OF THE PAPER.
DRAW TWO NUMBER LINES AND LABEL THEM.
NUMERATOR
0 1 2 3 4
DENOMINATOR
0 1 2 3 4
TO SHOW 2/3, COUNT 3 SPACES TO THE RIGHT TO THE LINE MARKED 3..
NUMERATOR
0 1 2 3 4
DENOMINATOR
0 1 2 3 4
3
2/3
...AND 2 SPACES UP TO THE LINE MARKED 2..
NUMERATOR
0 1 2 3 4
2
DENOMINATOR
0 1 2 3 4
2/3
DRAW A LINE FROM THAT POINT TO THE ZERO POINT.
NUMERATOR
0 1 2 3 4
DENOMINATOR
0 1 2 3 4


TO SHOW 3/4, START AGAIN AT THE ZERO POINT.
NUMERATOR
0 1 2 3 4
DENOMINATOR
0 1 2 3 4
GO 4 SPACES TO THE RIGHT.
NUMERATOR
DENOMINATOR
4
3/4
GO UP 3 SPACES.
3
3/4
NUMERATOR
DENOMINATOR
DRAW A LINE FROM THAT POINT TO THE ZERO POINT.
NUMERATOR
DENOMINATOR
THE STEEPER LINE SHOWS THE BIGGER RATIO. THE LINE FOR 3/4 IS STEEPER. IT HAS A GREATER SLOPE.
3/4 IS BIGGER THAN 2/3.
3/4
2/3
NUMERATOR
DENOMINATOR
WHAT HAPPENS WITH 1/2 AND 4/8?
THEY ARE THE SAME! HOW DOES A SLOPE DIAGRAM SHOW THAT?
NUMERATOR
0 1
0 1 2
DENOMINATOR
HERE'S 1/2
HERE'S 4/8
0 1 2 3 4
0 1 2 3 4 5 6 7 8
DENOMINATOR
THE LINE FOR 1/2 AND THE LINE FOR 4/8 HAVE THE SAME SLOPE


WHICH KIND OF RADISH WILL GIVE US THE MOST PLANTS?
LET'S PLANT SOME OF EACH.
RED BUD
EARLY CRIMSON
18 19, ...
RED BUD
EARLY CRIMSON
MARCH 12
RED BUD
PLANTED 20
EARLY CR
PLANTED
20
RED BUD
EARLY
EARLY CRIMSON
1, 2, 3, ...
MARCH 12
RED BUD
PLANTED 20
EARLY CRIMSON
PLANTED 30
...28, 29, 30.
RED BUD
EARLY CRIMSON
TWO WEEKS LATER
...20, 21, 22.
MARCH 27
RED BUD
PLANTED 20
CAME UP 16
EARLY CRIMSO
PLANTED 30
CAME UP 22


MORE OF THE EARLY CRIMSON CAME UP. SHOULD WE CHOOSE THEM?
BUT WE PLANTED MORE OF THEM.
RED BUD
EARLY CRIMSON
YOU NEED TO FIND OUT WHICH RADISH DID BETTER.
RED BUD
PLANTED 20
CAME UP 16
EARLY CRIMSON
PLANTED 30
CAME UP 22
16 OUT OF 20 RED BUD CAME UP.
22 OUT OF 30 EARLY CRIMSON CAME UP.
MAKE A SLOPE DIAGRAM FOR THE RATIOS.
16/20
16
20
NUMBER CAME UP
NUMBER PLANTED
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
22/30
22
30
NUMBER CAME UP
NUMBER PLANTED
THE LINE WITH THE GREATER SLOPE SHOWS WHICH RATIO IS BIGGER.
RED BUD
EARLY CRIMSON
NUMBER CAME UP
NUMBER PLANTED
THE LINE FOR RED BUD HAS THE GREATEST SLOPE
RED BUD
PLANTED 20
CAME UP 16
EARLY CRIMSON
PLANTED 30
CAME UP 22
WE SHOULD PLANT RED BUD.

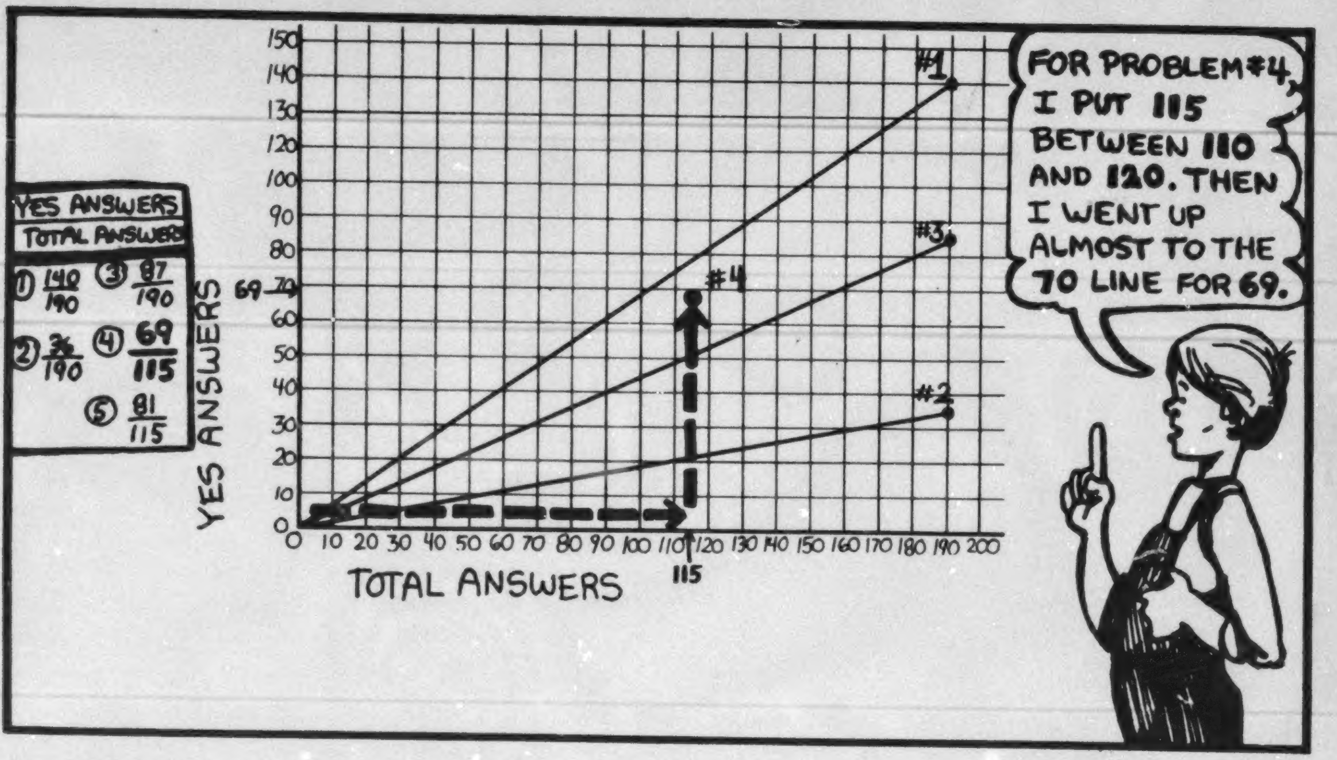

WHICH BRAND GIVES US MORE FOR OUR MONEY?
HOW MUCH DOES ONE OUNCE OF EACH BRAND COST?
79¢ ZAP POTATO CHIPS 9OZ.
49¢ POW POTATO CHIPS 4OZ.
BRAND ZAP POW
PRICE 79¢ 49¢
WEIGHT 9 OZ. 4 OZ.
WE CAN FIND OUT BY DIVIDING THE PRICE BY THE NUMBER OF OUNCES.
THOSE ARE TOO HARD TO DIVIDE.
ZAP 79¢/9OZ.
POW 49¢/4OZ.
A SLOPE DIAGRAM WILL DO THE DIVIDING FOR YOU. LOOK AT THE SLOPES OF THE LINES.
79
49
COST (CENTS)
0 10 20 30 40 50 60 70 80
0 1 2 3 4 5 6 7 8 9 10
WEIGHT (OUNCES)
POW
ZAP
COST (CENTS)
0 10 20 30 40 50 60 70 80 90
0 1 2 3 4 5 6 7 8 9 10
WEIGHT (OUNCES)
THE SLOPE FOR ZAP IS SMALLER THAN THE SLOPE FOR POW...
ZAP COSTS LESS PER OUNCE. WE'LL BUY ZAP.
YUM YUM
79¢ ZAP POTATO CHIPS 9OZ.

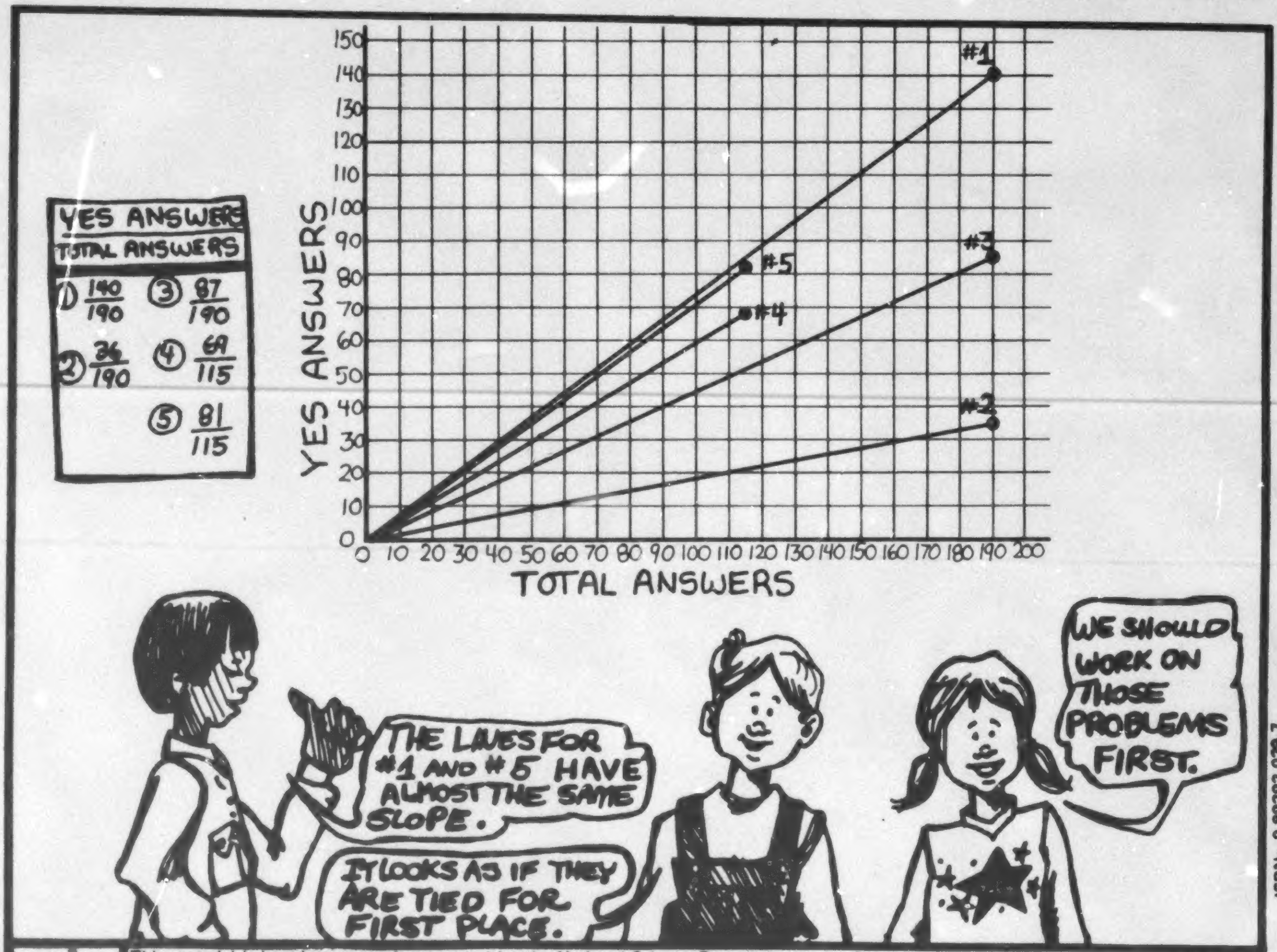


DO YOU HAVE THESE PROBLEMS IN DESIGN LAB?

	YES	NO	TOTAL
1. PEOPLE DON'T CLEAN UP	140	50	190
2. WAITING TO USE TOOLS	36	154	190
3. HARD TO FIND THINGS	87	103	190
4. PROJECTS GET RUINED	69	46	115
5. NEED MORE MATERIALS	81	34	115

WHICH PROBLEM IS THE MOST IMPORTANT?
OOPS! I FORGOT TO ASK QUESTIONS #4 AND #5.
PROBLEM 1 HAD THE MOST YES ANSWERS.
THAT MAKES THE TOTALS DIFFERENT. WE CAN'T COMPARE YES ANSWERS.
A SLOPE DIAGRAM WILL TELL US WHICH PROBLEM GOT THE LARGEST PERCENTAGE OF YES ANSWERS.
YES ANSWERS
TOTAL ANSWERS
1. 140
2. 36
3. 87
4. 69
5. 81
190
190
190
115
115
DIFFERENT
THE NUMBERS ARE TOO BIG FOR OUR GRAPH PAPER.
LET'S MAKE EACH SPACE STAND FOR 10.
0
10 20 30 40 50
YES ANSWERS / TOTAL ANSWERS
① 140/190
③ 87/190
④ 69/115
② 36/190
⑤ 81/115
YES ANSWERS
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
TOTAL ANSWERS
...AND UP TO THE LINE FOR 140.
FOR PROBLEM #1, WE WANT TO FIND 140/190. WE'LL GO OVER TO THE LINE FOR 190...


YES ANSWERS
TOTAL ANSWERS
① 140/190 ③ 87/190
② 36/190 ④ 69/115
⑤ 81/115
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
YES ANSWERS
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
TOTAL ANSWERS
115
69
#1
#3
#4
#2
FOR PROBLEM #4, I PUT 115 BETWEEN 110 AND 120. THEN I WENT UP ALMOST TO THE 70 LINE FOR 69.


YES ANSWERS
TOTAL ANSWERS
① 140/190 ③ 87/190
② 36/190 ④ 69/115
⑤ 81/115
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
YES ANSWERS
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
TOTAL ANSWERS
#1
#5
#4
#3
#2
THE LINES FOR #1 AND #5 HAVE ALMOST THE SAME SLOPE.
IT LOOKS AS IF THEY ARE TIED FOR FIRST PLACE.
WE SHOULD WORK ON THOSE PROBLEMS FIRST.

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